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OUR GRAIN CROP AND ITS COMMERCIAL IMPORTANCE.

During the past decade the production of breadstuffs in this country, as shown in the latest census reports, has been nearly doubled. During the same period the exportation of breadstuffs has increased fourfold. It is now more than ten times as great as it was twenty years ago, and more than twenty times what it was thirty years ago. As given by the Bureau of Statistics the total exportations were:

In 1850	\$13,066,500
" 1860	24,442,330
" 1870	72,250,933
" 1880	298,006,835

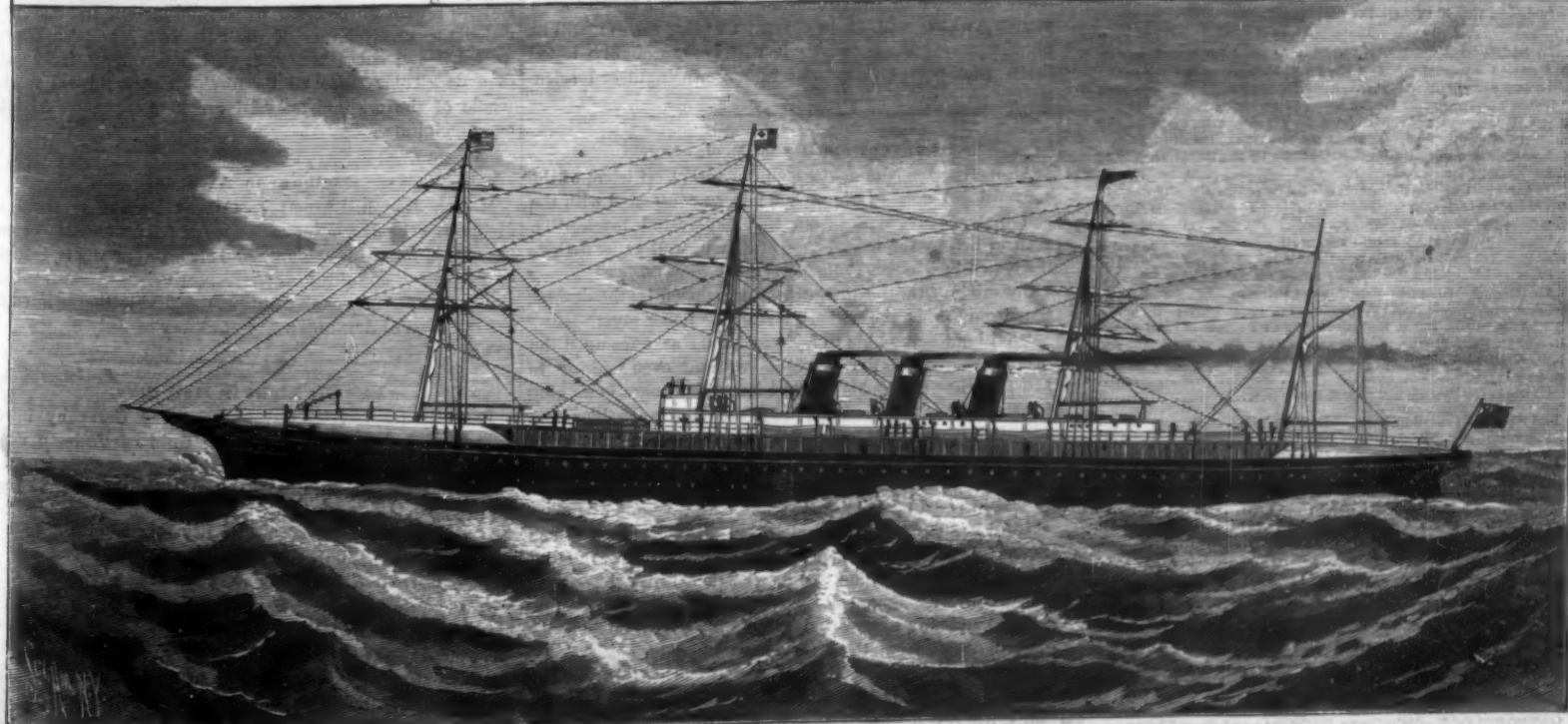
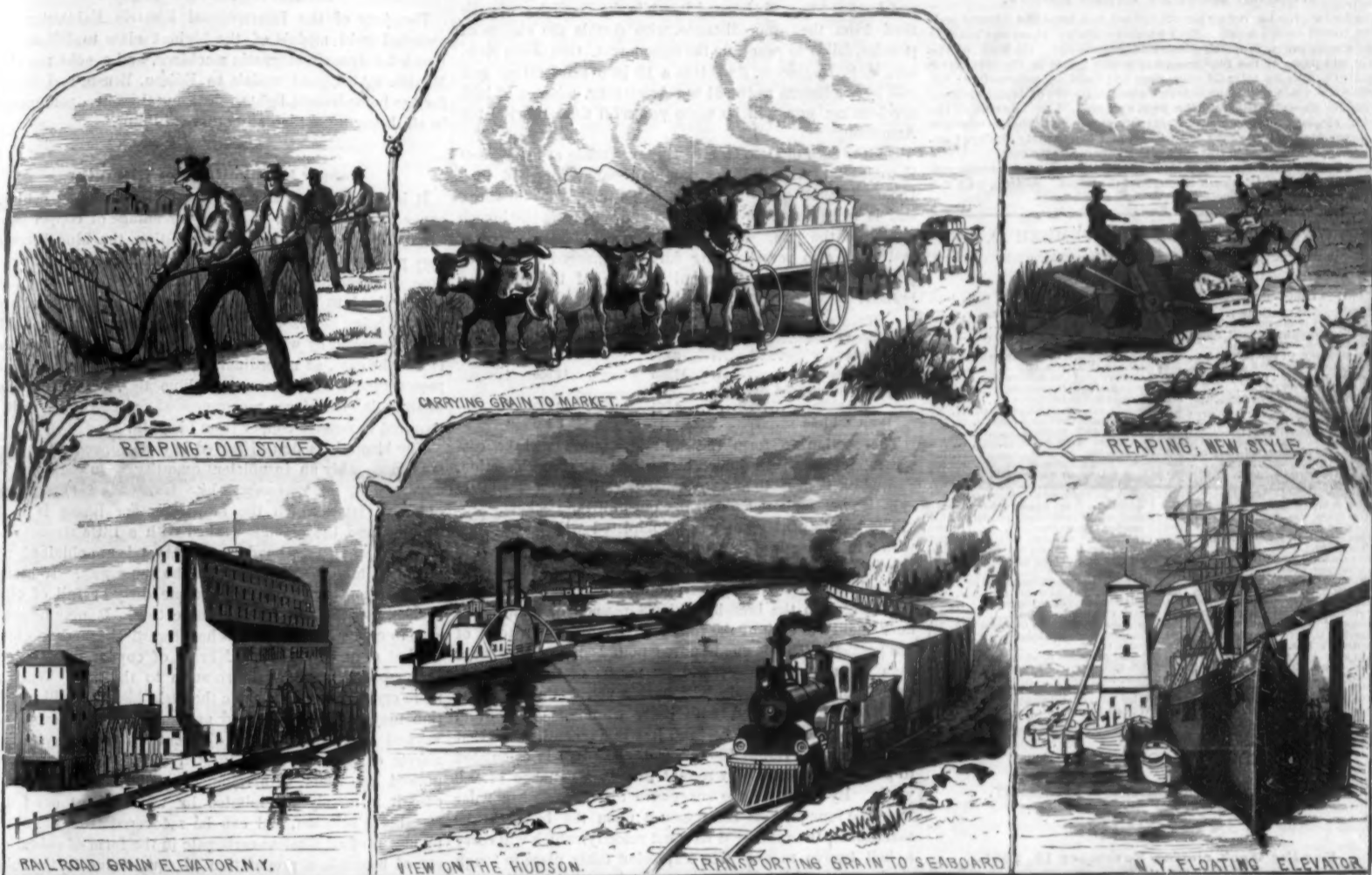
In 1850 the total production of wheat was a little over a hundred million bushels, of which the portion exported was less than four-fifths of one per cent. In 1880 the yield was close upon 450,000,000 bushels, of which 34½ per cent was exported. Of the second great staple, corn, the yield in 1850 was nearly 600,000,000 bushels, of which 1·11 per cent was exported. In 1880 the yield was nearly 1,548,000,000 bushels, 6·34 per cent being exported. The entire grain crop of last year—corn, wheat, barley, oats, rye, etc.—approached 2,700,000,000 bushels, valued at \$2,000,000,000. During the first eight months of the current year, the exportation of bread-

stuffs has exceeded \$30,000,000 a month, a material falling off from last year's business, owing partly to better crops abroad and partly to the fact that prices have been kept up by speculative holding of grain for higher prices.

The apparent increase in the corn crop during the past decade was 133 per cent. In the census year (1879) the three principal corn-growing States produced more corn than the entire country did in 1860. The increase in Kansas was five-fold, and in Nebraska still greater.

The gain in the wheat crop was 78 per cent in the last

[Continued on page 308.]



THE NEW STEAMER "CITY OF ROME," 8,000 TONS BURDEN.—ENGINES, 10,000 HORSE POWER.

THE COMMERCE OF NEW YORK.—TRANSPORTATION, STORAGE, AND SHIPMENT OF GRAIN.

Scientific American.

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NEW YORK, SATURDAY, NOVEMBER 12, 1881.

Contents.

(Illustrated articles are marked with an asterisk.)

Agricultural Inventions.....	319	Inventions, miscellaneous.....	312
Air comp. for elevated railroad.....	324	Inventions, new.....	312
American Institute Exhib. notes.....	308	Inventions, recent.....	307
Antoni's the longevity of.....	318	Iron in horses (4).....	315
Arts, military of the Amazon.....	314	Lakes, great U. S. fisheries of the.....	314
Atmospheric pressure.....	319	Light of the stars, the.....	314
Bleaching machine, plate glass.....	319	Longevity of the ancients.....	312
Bottles, to cut off (3).....	315	Lyman-Haskell cannon.....	304
Buffalo skins, new use for.....	317	Mechanical Inventions.....	311
Calcium.....	312	Medals, etc., reproduction of.....	315
Canal, Panama, the.....	312	Military ants of the Amazon.....	314
Cannon, Lyman-Haskell.....	304	Motor, small, wanted.....	309
Cement (4).....	315	Moving of large hotel.....	316
Cement and plaster, painting of.....	315	Nature, the, of coal.....	310
Cementa (13).....	315	Notes and queries.....	315
Coal, the nature of.....	310	Oil painting on woven fabrics.....	314
Compressed air for elevated R.R.	324	Organ reed, new.....	307
Conventuality in designing.....	311	Painting of cement and plaster.....	319
Copper in sublimate of bismuth.....	311	Painting, oil, on woven fabrics.....	314
Cotton fiber, structure of.....	315	Paint, transparencies prod. by.....	314
Deadly fly, the, in Texas.....	319	Panama Canal, the.....	309
Designing, conventionality in.....	311	Pipette, convenient, a.....	312
Drilling, fire.....	317	Plate glass beveling machine.....	310
Energy, expend. of in incand. light.....	311	Pneumatic riveting machine.....	310
Engineering Inventions.....	312	Reed, organ, new.....	307
Exhibition notes, Am. Institute.....	308	Riveting machine, pneumatic.....	310
Exhibition, proposed, in Boston.....	311	Skins, buffalo, new use for.....	317
Extraction of sulphur from ore.....	311	Shot case and distributor.....	314
Fabrics, woven, oil painting on.....	314	Stars, the light of the.....	314
Fiber, cotton, structure of.....	315	Sulphur, extraction of from ore.....	311
Fisheries, U. S. of the great lakes.....	314	Telegraph wire jointer.....	310
Fly, deadly, the, in Texas.....	319	Tools, new.....	310
Grain crop.—Its com. importance.....	314	Transparencies prod. by paint.....	314
Hotel, large, moving of a.....	316	U. S. fisheries of the great lakes.....	314
Inventions.....	308	Use, improved.....	311
Inventions, agricultural.....	319	Waxes and their nests.....	315
Inventions, engineering.....	312	Wire jointer, telegraph.....	310
Inventions, mechanical.....	311	Woven fabrics, oil painting on.....	314

TABLE OF CONTENTS OF THE SCIENTIFIC AMERICAN SUPPLEMENT.

No. 306,

For the Week ending November 12, 1881.

Price 10 cents. For sale by all newsdealers.

I. ENGINEERING AND MECHANICS.—Siemens' Electric Tramway at Paris. 1 illustration. The Electrical Exhibition at Paris.—The electrical railway.....	4872
Electric Railways and Transmission of Power by Electricity. By ALEXANDER SIEMENS. An elaborate argument in favor of the practical application of electricity for the transmission of power. Critical discussion of Dr. Siemens' lecture by the Royal Society of Arts, London.....	4872
On the Limiting Number of Teeth for Spur Wheels. By Prof. C. W. MACCORD. I. Outside Gearing.—Epicycloidal Teeth. II. Inside Gearing.—Epicycloidal Teeth. 8 figures.....	4874
Trial Trip of the Almirante Brown, the new twin-screw armored corvette built for the Argentine Republic.....	4876
Improved Moulding Machine. 1 figure.....	4877
The Magnetic Separating Machine at Pribram. 1 figure.....	4877
Brick and Concrete and Concrete Gas Holder Tanks. By W. H. EMBINGER. Prize paper, Institute of Civil Engineers. Construction of tanks. 5 figures. Sections of walls at dry well, trench, and pier.—Timbering, etc.—Composition of the concrete.—How the concrete was made.....	4877
Concrete for Embankments and Dams.....	4879
II. NATURAL HISTORY, ETC.—The Population of Prussia.....	4881
Expansion and Contraction of Tree Trunks.....	4881
Varieties of Linseed in English Commerce. By E. M. HOLMES.....	4882
24 figures.....	4882
The Army Worm.—1 figure.—Larva, pupa, and moth in an oat field.....	4884
Poultry Farming.—19 figures.—Examples of rare poultry raised in Germany.....	4884
Timber Trees from Seeds.....	4886
III. GEOGRAPHY, GEOLOGY, ETC.—The Present State of Mount Etna and the Valle del Bove.—2 figures.—Mount Etna as seen from the Port of Catania.—Map of the upper region of Etna.....	4881
IV. TECHNOLOGY AND CHEMISTRY.—Destructive Distillation. By EDWIN MURKIN.....	4880
Preparation of Neutral Oxide of Potassium. By E. B. SHUTTLEWORTH.....	4880
V. METEOROLOGY.—Rain Drops, Halitones, and Snow Flakes.....	4880
VI. ARCHITECTURE, ETC.—The New Cincinnati Union Depot.—1 figure.....	4876

THE NEW LYMAN-HASKELL CANNON.

The Lyman-Haskell accelerating or multicharge cannon is made with a succession of cylindrical chambers called "pockets" below the bore whose axes point toward the muzzle of the gun and form with its axes angles of about 60 degrees. In these pockets are placed the accelerating charges of powder that ignite after the passage of the projectile, which is started by the explosion of the initial charge in the gun chamber, in the usual manner.

Col. J. H. Haskell, of New York, adopting the accelerating principle first introduced by A. S. Lyman, also of New York, the inventor of the "Lyman accelerating gun," has made a number of improvements on it which are now the property of these two gentlemen jointly with their assigns.

The new Lyman-Haskell gun is expected to throw a projectile four calibers in length a distance of ten or twelve miles, leaving the gun at a velocity of 4,000 feet per second, which, it is claimed, can be done without the danger of bursting the piece, which would occur if the necessary force were generated by the explosion of a single charge.

A number of tests of the principle have been made; notable among them are those at the Washington Navy Yard, where a 2½ inch accelerating gun was tested in competition with a 5 inch Whitworth (English) gun. The target consisted of 5 inches of iron plates backed with 18 inches of oak timber. At a distance of 200 yards, the projectile from the accelerating gun went entirely through this target and landed 100 yards beyond it, while the English projectile fired from the same distance, with double the charge of powder, failed to penetrate the same target. Gen. John Newton, U. S. Engineers, finds that a 10 inch accelerating gun will be as efficient as the 81 ton Armstrong, while a 12 inch accelerating gun will be more powerful than the 100 ton Armstrong.

On the 24th of October a casting was made at the "Scott Foundry" of the Reading Iron Company, for a 6 inch Lyman-Haskell gun. This casting is made without cores, and is to be bored for the pockets and will form the breech section of the gun. Its weight is upward of 50,000. It was cast from two reverberating furnaces charged with 50,000 pounds of cold-blast charcoal pig-iron of the following brands:

Brands.	No. 1 Furnace.	No. 2 Furnace.
Maiden Creek.....	3,680 pounds.	2,745 pounds.
Junata.....	3,670 "	2,745 "
No. 2 Richmond.....	15,425 "	11,555 "
Falling Spring and No. 1.....		
Franklin.....	4,775 "	3,575 "
Remelted iron.....	4,545 "	3,400 "

The section to form the muzzle portion will be cast separately, and firmly joined by socket to the breech section. The whole is to be then lined with steel in one continuous cylinder for the bore and smaller ones for the pockets.

The weight of the gun when completed will be 25 tons, with a total length of 24 feet 11½ inches. It will have a bore of 6 inches, and will carry a ball weighing 150 pounds, of 4 calibers length. Eighteen pounds of hexagonal powder will be used in the breech, with 28 pounds of powder of finer quality in each of the four pockets, making a total of 130 pounds. This is one hundred pounds more of powder than is ordinarily used, and by means of this system of explosion, the projectile will have a penetrating power as 1½ is to 4, compared with other cannon. The initial velocity of the ball will be 4,000 feet in a second, while that of other guns is from 1,500 to 2,000. The ball is calculated to penetrate two feet of wrought iron at a distance of 200 yards. By means of the successive discharges of powder from the four pockets the pressure upon the ball will be maintained, thus giving it its great velocity, which will carry a ball twelve miles. The explosion takes place in tough steel, supported by the strongest cast iron. After its completion, which will be in several months, the gun will be taken to Sandy Hook, where it will be thoroughly tested in the presence of army officers and distinguished scientists.

Conventionality in Designing.

An instructive commentary on our recent criticism of the conventional work of the art schools, as contrasted with the genuinely artistic work of our tool makers and machinists, is furnished by the recent competition in wall paper designs instigated by Messrs. Fuller & Warren.

Speaking of the disappointment occasioned by the designs sent from France the critic of a morning paper says:

"Without being able to lay our hands at once upon the original sources of these designs—without even wishing to say that they are copies—we yet know that there is nothing in them that is not familiar; they are mere variations, and not at all clever ones, on the fashionable stock-in-trade of the day. Some of them are suggestive of the tapestries of French manufacture. One of them has a "filling" that is inspired by Persia; there are two very good borders, skillful treatment of old models, but of the most of them Japan is the fruitful mother—Japan treated rather cavalierly, after the French fashion. But whatever it may be—tapestry, Persia, or Japan—it is all copying, skillful, accomplished, and thorough workmanship, but all inspired by books and all drawn from the brains of other men."

In a later paper, speaking of the absence of originality displayed in nearly if not quite all of the designs submitted, the critic is constrained to say that "it is beginning" to be felt that the production of good designs by any of the now long-tried methods of art schools, schools of design, South

Kensington schools, and the like, is less and less to be depended on. There has been for some time in England much groaning and complaint over the failure of the costly governmental methods employed to stimulate the faculty of design in the British subject, and whether the peoples of the continent are as well alive to their own failure or not, it is nevertheless true, that not only the Germans, the Austrians, and the Italians, but even the French, are reduced to the imitation of the work of the past in every department of manufacture calling for design. It is true they have carried this imitation, not only in the design, but in the manufacture itself, to the very highest point of perfection, so that the brocades and stuffs of all kinds, the metal works, the ceramics, the tapestries, carving in wood and stone, the glass, etc., that are produced to-day are, in all cases where price is of no importance, as well made as they ever were at any time, and even when a cheaper market is looked for these things are often of a very high degree of excellence. But original design has by no means kept pace with manufacture, and though there are a few striking exceptions to the statement, it may be safely said that in design to-day we are dependent on the work of those who have gone before. The design of to-day consists in clever copying or clever combining of what has been produced by other people in other times."

Medals for Electric Lights.

The jury of the International Electric Exhibition has awarded gold medals of the highest class to Edison and Brush for dynamo magnetic machines, and a gold medal to Maxim. Also, gold medals to Edison, Brush, and Maxim for arc incandescent lights. Edison takes five gold medals in all, being more than any other exhibitor.

Copper in Sublimate of Bismuth.

It is well known that commercial bismuth often contains copper, and that even when the percentage of copper is too small to color the nitric acid solution, the blue becomes very perceptible upon the addition of ammonia for the purpose of precipitating the sublimate. At first thought we are inclined to think that the ammoniacal compounds of copper, being very soluble in excess of that alkali, would be easily removed by washing, but experience proves that this is not the case, as no ordinary care, nor even extraordinary perseverance, can remove the blue tint. The following method is, therefore, recommended in cases where it is required to remove copper from bismuth.

The bismuth is first dissolved in cold concentrated nitric acid, preferably an insufficient quantity. On the following day a mass of perfectly white transparent crystals are obtained, from which the bluish mother liquor is to be drained, and the crystals washed with a little strong acid. In a day or two a second crop of crystals are obtained, and are also drained and washed in the same way. If by this time the mother liquor has become dirty or full of black specks, it is filtered through gun cotton. It may be necessary to concentrate it somewhat toward the end to obtain the last crop of crystals. Nitrate of copper, being exceedingly soluble, remains in solution to the last. When no more crystals are obtainable the little bismuth still in solution may be precipitated by ammonia, washed, dried, and worked over again. The different crops of crystallized nitrate of bismuth are triturated with a little water and poured into water, or ammoniacal water, as preferred. In case it is merely precipitated by water, about one-fourth remains in solution, and can be recovered from the filtrate by means of an alkaline carbonate in the form of subcarbonate of bismuth, a preparation of equal value to the sublimate. Where purification by crystallization has not preceded the precipitation of the sublimate, the second product, namely, subcarbonate from the filtrate, is frequently of a dark color, since all the foreign metals present in the whole of the original material are here concentrated into one precipitate.

Melbourne Awards.

Messrs. Joseph Burnett & Co., of Boston, received at Melbourne the first order of merit for flavoring extracts and the second order for colognes and chemical products, instead of the second and third orders respectively, as was stated in the report of American awards at that Exhibition printed in the SCIENTIFIC AMERICAN SUPPLEMENT of July 2.

Electric Light in Rail Cars.

Recently the Brighton (Eng.) Railway Company introduced the electric light on a special train of Pullman cars. Thirty-two Faure secondary batteries were employed to the car, to operate a dozen Swan lamps. The illumination was said to have been satisfactory.

A Compressed Air Motor for Elevated Railways.

A very promising trial was lately made of a compressed air motor on the Second Avenue Elevated Road. The air was stored in four tanks, under a pressure of 580 pounds. After running from 127th street to 42d street and back, making the usual stops, the pressure was reduced to 125 pounds. The inventor claims that with proper facilities at each end of the road the motor can be charged in from two to three minutes time.

THE STRUCTURE OF COTTON FIBER IN RELATION TO DYEING.

The organic structure of the various cotton fibers of commerce, as affecting their use in spinning and weaving, was considered in a previous article. Let us now examine briefly the influence of fiber structure upon the work of the dyer.

In what manner does the fiber receive the dye, and what changes are wrought in the structure and chemical composition of the fiber in the processes of dyeing?

The fiber, as we have seen, is a slender, twisted, usually more or less flattened cellular tube, the outer walls of which show no openings even under a powerful microscope. When perfectly ripe the fiber consists of almost perfectly pure cellulose, a compound of carbon, hydrogen, and oxygen ($C_6H_{10}O_5$), having but slight affinity for other substances, except strong acids and alkalies.

Obviously there are many supposable ways in which such a structure can be dyed: by the laying on of dyestuff like paint upon the surface of the fiber; by the filling of the tube with liquid dye, which may or may not afterward be precipitated in solid form; by saturating the cell walls with dye; by a chemical union of the substance of the fiber with the dyeing materials, etc.

It is quite probable that each and all of these methods will be found to operate singly or in combination under the varying conditions obtaining in dye houses.

The fixation of the color in the fiber is effected, according to Chevreul, in three ways: by chemical affinity, by simple mixture with the fibers, or by a combination of the two. The English investigator, Mr. Walter Crum, holds that in the dyeing of cotton fiber the action is purely mechanical, and that reactions which occur in the fiber are not effected by the chemical composition of the fiber. The fiber, he says, serves simply as a containing vessel, and is as inert as a glass tube might be. The peculiar structure of the cotton fiber, however, enables it to take in liquids which contain coloring matter in a feeble combination with the solvent liquor, and to retain such matter when the liquid is removed or the dye precipitated by a reagent. The energy of the absorbent action of cotton fiber is so great that some dyes will penetrate the fiber even when the dyestuff is applied in a condition almost solid. Other dyes do not so strongly support the theory of Mr. Crum. Thus, aniline colors, which are eagerly absorbed by silk and wool, have little effect upon unprepared cotton fiber, except to stain the surface.

The more recent investigator, Mr. F. H. Bowman, reviews in his new work the grounds of Mr. Crum's position, and decides that something more than mechanical action is needed to account for the conditions observed under the microscope. With respect to their action upon the fiber of cotton he finds three classes of dyeing substances:

(1) Those which are colored in themselves; simple dyes having a direct affinity for the fiber without the intervention of a mordant.

(2) Those which are true chemical precipitates formed within the fiber walls; with these the fiber acts mechanically and does not in itself undergo any change.

(3) Those requiring a mordant. With these the color is not produced by the simple union of the coloring matter with the fiber, but by the action of various reagents upon the mordant, which unites with the fiber and thus fixes the color.

He adds that it is not possible to draw a sharp line of demarcation between these three classes of action, because in the relationship of various coloring matters to the fibers they shade into one another; and there are many instances in which the difference is only one of degree. Examples of the appearance of fibers under the microscope, after treatment with the different types of dyestuffs, are shown by Mr. Bowman in a series of beautifully colored illustrations.

Turmeric yellow and indigo blue illustrate the action and appearance of the first class of dyeing material. With turmeric yellow the coloring matter is simply dissolved in hot water; immersed in the decoction the fiber speedily acquires a bright yellow color, which is rendered as permanent as the color will permit by simply drying the yarn. The coloring matter is not merely entangled in the cell structure of the fiber, for it cannot be dissolved out by a reapplication of water. There is an evident union of some sort with the fiber substance. The aggregation of coloring matter within the cell walls shows further that the fiber has the power of attracting the dye from the water, which is left considerably less colored than the fiber which has been immersed in it. When examined under the microscope by transmitted light the coloring matter is found to be irregularly distributed, the coloring lying in detached masses in the cellulose walls. In some places, especially when the fiber is kempy or immature, the fiber seems to have no affinity for the dye and is incapable of receiving it. How far and in what way the presence of foreign matter, such as wax, oil, and cell contents, interferes with the proper action of the cellulose layers and prevents uniform dyeing, does not appear.

The affinity of cotton fiber for indigo is such that the fiber tends to accumulate the indigo within the cell walls in quantity almost proportionate to the time during which it is in operation. With a sufficient quantity of cotton all the indigo may be extracted from the solution.

When the dyed fiber is viewed under the microscope the cloudy deposit of indigo is seen distributed irregularly through the fiber, in some places forming dark, almost black, masses in the central cavity. There is also a certain degree of surface coloration, and an accumulation of color in the creases, on the wrinkled and broken surface of the collapsed tubes, or in the ridges and furrows occasioned by the hollows

of the twisted fibers. To the reflecting surfaces so formed the solid and even appearance of this dye is largely due. A careful examination of the best dyed fibers, however, convinces Mr. Bowman that we are far from the standard of perfect dyeing, and that the mechanical treatment of the fiber is much more advanced than the chemical.

The second class of dyeing substances, where true chemical precipitates are formed within the fiber walls, is best illustrated by the pure mineral dyes, such as chrome yellow, Prussian blue, etc. In these the reaction within the fiber producing the color is exactly the same as that which occurs in the test glass on the laboratory table, when testing for lead or iron; and the great problem for the dyer to solve is so to prepare the fiber that it will best receive the solution from which the coloring matter is to be precipitated.

Mr. Bowman finds that in many cases with these purely mineral dyes the cellulose may be entirely dissolved away by properly selected solvents, leaving the dyes in an unchanged condition, showing that they had not entered into chemical union with the fiber. In other cases there seems to be a degree of affinity between impure cellulose as it always exists in the cotton fiber, and the first solutions in which the fiber is immersed in order to produce the purely mineral dyes, so that they may act to some extent as mordants. Thus he found by experiment that when cotton fiber was steeped in acetate of lead (the first process in the dyeing of amber), or in nitrate of iron (the first step in dyeing Prussian blue), he could not by any process which did not entirely destroy the fiber remove all traces of these bases. The inference was that something more than mere mechanical union had taken place between them and the fiber; and although the cellulose itself might play no part in the subsequent reactions, the fixity of the color seemed to be due in part at least to the reaction of the bases upon the cellulose, making the dyes to a certain extent chemical as well as mechanical.

The third class of dyeing substances (where a mordant is used) is greatly variable in nature and application. In some cases there seems to be what may almost be called the formation of a new surface within the fiber walls, or even upon the surface of the thread (but permanently attached to it), upon which the coloring matter is deposited. Thus pure cotton fiber will not receive and hold an aniline dye, but when first treated with a solution of tannic acid the fiber will take up the color in large quantity and hold it permanently.

Under the microscope fiber dyed with any of the aniline colors shows a much greater uniformity in the levelness of the dyeing than obtains with indigo. Sections of the fiber seem to be uniformly colored all through the cell walls, and there is a comparative absence of surface coloring and the tendency to form detached masses of dye. Some fibers indeed seem to be perfectly dyed in every part, as though the mordant had penetrated every portion of the cell walls. This is true only of perfect fibers; unripe fibers naturally resist the color.

To make these refractory fibers receive the dye they have to be treated with strong alkali, "mercerized," which has the effect of thickening the cell walls and increasing their power of absorption. Mr. Bowman finds that such unripe fibers could also be made to receive aniline dyes by first bleaching them or by boiling them for a time in a weak solution of alkali. This increased capacity for dyeing, he thinks, may arise from the removal of waxy matter from the outer layer, or else from the opening of the pores of the fiber, although the same treatment seems to diminish the power of the tube wall to act as a dialyzer when treated with salts of alumina.

Alumina has a special interest in connection with cotton fiber, not only because of its peculiar property, when in its hydrated condition, of throwing down and heightening the brilliancy of many vegetable and animal coloring matters, but also because of its being separated from its various compounds by the dialytic action of the fiber alone, and thus retaining these coloring matters within the cell walls in an insoluble condition. Upon this action depends the process of dyeing Turkey red, one of the most stable of all colors.

The manner in which coloring matters of this class are associated with different fibers—kempy, unripe, fully ripe, etc.—is admirably shown in Mr. Bowman's illustrations. After treatment with lake of alumina and madder the kempy fiber shows many parts quite uncolored. In the unripe, horny fiber the coloring matter is confined to a thin layer, which by the act of shrinking has separated into detached flakes distributed irregularly through the thin tube. The fully dyed fiber shows the accumulation of coloring matter in the interior of the tube. In the transverse sections of fiber some are faintly colored in spots; others show the dye collected in clots within the tube. The distribution of the dye in the cell walls is also irregular. Sometimes the dye lies in layers; other fibers are uniformly tinted throughout; still others show an uncolored outer skin with a well dyed interior.

After considering at length the conditions of the fiber and the accidents of handling which interfere with the work of the dyer, Mr. Bowman expresses the opinion that increased efficiency in the coloring of yarn and fabrics must be looked for in the discovery of new preparatory processes which, like the strong alkali treatment, will increase the capacity of the fiber for receiving dye, especially imperfect and immature fibers, and also give to the mature fiber greater toughness and strength. Here would seem to be a promising field for investigation and invention. The wonderful change which occurs in the manufacture of parchment paper, by which the strength of the paper is increased eight or ten fold, indicates

that there must lie within the reach of possible discovery a corresponding chemical process of strengthening cotton yarn while dyeing it, since both the paper and the yarn have the common basis, cellulose.

REPRODUCTION OF MEDALS, ETC.

There are several methods by which medals may be reproduced, and of these the following are the simplest and afford the most satisfactory results:

THE STEREOTYPE PROCESS.

The medal, thoroughly cleansed, dried, and coated with a thin but uniform film of pure sperm or olive oil, is bound around the edge with a piece of cardboard so as to form a box, the bottom of which is the medal. A small quantity of finest plaster of Paris is then mixed up quickly into a thin cream and applied all over the exposed surface of the medal with a camel's-hair pencil so as to fill all depressions and exclude air bubbles. A thicker cream of plaster is then at once poured in until the box is nearly or quite filled. When the plaster has properly hardened the cardboard is taken off, and the plaster adhering to the rim of the medal trimmed off with a knife; the medal can then be easily detached from the cast. Another cast may then be taken of the reverse side of the medal in a similar manner. These casts, after trimming, are set aside in a warm place until they become quite dry, and are then clamped securely, face upward, in a small shallow iron tray, so that their face is about half the thickness of the medal distant below the top or edge of the tray. The spaces in the tray about the casts are then filled up even with the inferior edge of the casts with plaster, *papier mâché*, or clay (dry). The tray thus arranged is put into an oven until the temperature of its contents is uniformly heated to about 250° Fah., when it is removed and immersed wholly below the surface of a potful of ordinary type metal heated just hot enough to make it quite liquid. As soon as air bubbles cease to escape the tray is slowly and steadily raised out of the pot, and the contents allowed to chill and harden in the air (sometimes it is preferable to plunge it in water, so as to facilitate the removal of the "cake" from the tray). When the plate of type metal is cut out of the tray a correct (reversed) copy of the plaster moulds will be found on its under surface, and when the superfluous metal has been cut away and the pieces trimmed to proper dimensions and thickness they may be soldered together back to back, and the edges cut, turned, or milled, as the case requires to produce a correct imitation of the original medal. Cleansed by dipping momentarily in a strong hot solution of caustic potash, and, after quickly rinsing in running water, in hydrochloric acid, it may be coated with silver or copper, if desired, by electro deposition.

BY ELECTROTYPY.

Melt pure white wax, and stir well into it while cooling about one-fifth its weight of finest flake-white (plumbic carbonate). Having uniformly coated the faces of the medal with a film of finest graphite or plumbago, arrange it in the box of cardboard as in taking the plaster stereo cast, and pour in the wax preparation previously heated just enough to make it semi-fluid. Having thus obtained a mould in wax of both faces of the medal, harden the wax in a cool place, then coat it perfectly with a film of pure graphite, wrap about the edges a number of turns of clean copper wire, and brush on plumbago so that the film of the latter may have contact with the wax and wire all around. Suspend the wax cast thus prepared by the copper wire in a saturated (or nearly saturated) aqueous solution of pure sulphate of copper, jarring it so that all bubbles of air may escape from the deep lines of the cast. Close in front, but not touching the immersed mould (or its connections), suspend by a copper wire a sheet of clean copper. Connect the copper by stout copper wire with the silver (or carbon) pole of a Smee battery of three cells (in series), and the copper wire on the mould, in a similar manner, with the zinc pole of the same battery, and let the deposition of copper on the mould proceed until it becomes thick enough to separate without breaking (about as thick as this paper). Then carefully detach it from the mould, embed the pieces, face downward, in dry plaster, and fill up (after drying) with melted type metal (or fusible metal). Trim to proper size and thickness, solder the pieces together, back to back, and cut or mill the edges to proper form. These copies may be coated with a thin film of silver by electro deposit. The surfaces may be given an aged appearance by immersing them for a few moments in a dilute solution of sulphide of soda in warm water.

When a copy, as produced by stereotyping, of a medal is taken in metal, the latter coated with plumbago, and immersed in a bath composed of three-quarters of a pound of sulphate of nickel and ammonia per gallon of water, under the conditions described in electrotyping with copper, a hard shell of nickel is obtained, which, when separated and backed with type metal, may be used as a die. It is difficult, however, for an amateur in electro-metallurgy to obtain good results in this way. Steel dies cannot be produced in this way. Moulds for stereo or ordinary casting should be heated.

For a fusible silver-white alloy melt type metal and mix it with one-eighth its weight of grain tin, remove from the fire, and stir well before pouring.

Proposed Exhibition in Boston.

After several months' inquiry the committee appointed to investigate the feasibility of holding a World's Fair in Boston have reported in favor of the enterprise, provided \$5,000,000 can be secured. The property known as Beacon Park has been offered as a site for the fair free of rental.

PORTABLE PNEUMATIC RIVETING MACHINE.

The old-time way of riveting boiler shells and similar work is fast giving way to the more scientific and economical method of doing it by machinery. Our engraving shows one of the simplest and best machines for this purpose. It is operated by compressed air, and is capable of driving rivets as rapidly and effectively as the larger and more expensive steam or hydraulic riveters now in use. Its operation imitates handwork, but the results are superior to handwork.

Fig. 1 shows the riveter operating on the side of a boiler shell. It is supported in a ring, so that it may be turned to any angle or work in any desired position. The hammer is brought into contact with the rivet head by a rapidly reciprocating piston working in the air cylinder, and the anvil is brought up to its work by the air cylinder between the shorter arms of the levers.

The long arms of the levers are made 63 and 76 inches from center of joint pin to the center of riveter, capable of reaching a rivet 60 or 72 inches respectively from the edge of the plate, so as to operate upon the circular seams of a boiler. The levers are turned in the ring by a worm-wheel to place the machine at any desired angle.

The valve of the riveter is operated directly by the pressure in the cylinder without extra gearing, and so arranged that the length of the stroke regulates itself automatically to correspond with the gradual reduction of the end of the rivet as the head is formed.

The machine is operated with an atmospheric pressure of from 20 to 30 pounds to the square inch, and makes from 150 to 200 strokes per minute. The time required to form the head of a three-quarter inch rivet is about six seconds, and at steady, straight work, allowing for ordinary detention and loss of time, two rivets can readily be finished in one minute.

The machine may be suspended from a bar arranged overhead to allow a longitudinal motion to the riveter when operating on straight seams, but a traveling carriage, capable of a longitudinal and side motion, is preferable, so that when operating against the side of the boiler shell, as shown in Fig. 1 (which is found to be the most convenient way of operating with the machine), the machine can easily be regulated for any diameter of shell.

Among the many advantages claimed for this riveter are its lightness and portability, its rapidity of action, and the great saving of labor in handling the work, beside turning out a better quality of work than can be done by hand.

This machine is one of the objects of interest at the present fair of the American Institute.

Further particulars in regard to this machine may be obtained by addressing Mr. Henry E. Raeder, 304 Broadway, New York city.

American Institute Exhibition Notes.

Persons who have annually visited the exhibitions of the American Institute have sometimes complained of sameness, but even to the most casual sightseer who may have had occasion to thus complain the exhibition now open at Sixty-third street and Third Avenue must be an agreeable exception. The introduction of nearly one hundred Brush electric lights make night as bright as day, and give colors their real shades. Two powerful steam engines are now driving six large Brush dynamo machines at the rate of about 800 revolutions per minute, and their glory is divided among the hundred lights in and about this large building.

This is the fiftieth exhibition given by this Institute, its first having been in 1828, and annually repeated each autumn, except four, since that year. It would be interesting to canvass the difference in the aspect of the world of science and art then and now. The fifty glimpses of it that these exhibitions have afforded would be a fair panorama of progress in most branches of industry, but space is not now available for even a sketch of the improvements that have appeared during these fifty-four years. It may be safely said that no like period has been correspondingly marked, as the age of improvement in arts and sciences. It is the age of steam, of steel, and of electricity.

To the careful and the special observers from year to year these exhibitions have shown the successive steps in the grand march of improvement in mechanical industries. Each

exhibitor has made some improvement in his specialties, either as to quality of products or facility in producing. From the fireman in his grim attire and with his simple tools, who furnishes the prime force, through all the types of machines that his product moves, and the delicate as well as ponderous products of these machines to the aesthetic and beautiful you may learn the little story of recent technical progress from each.

Among the giants of the exhibition that overcome nature's solid work, destroying instant the cohesion that for ages upon ages has held the solid rocks in form, is the crushing machine, which will give you a noisy proof of its ability to disintegrate one hundred tons in ten hours of blue stone, granite, or quartz. It is the celebrated Blake challenge rock breaker, gnashing 275 times per minute at its uncanny

Vulcanized rubber fabrics for all mechanical purposes are shown in full line by the New York Belting and Packing Company, the oldest and largest manufacturers in this country. They also exhibit fine specimens of rubber-lined cotton fire hose, which receives in the course of its manufacture a vaporous carbolic acid treatment to prevent mildew and rot, to which all cotton goods exposed to wet and dry are otherwise liable. It is known as "cable hose," and is circular wove and therefore seamless. It will stand extraordinary and long continued internal strain without bursting. Notable among these exhibits are three immense grain elevator belts. One pair called the "Twin Giants" are 36 inches wide, 275 feet long, and weigh 2,800 pounds. A third and still wider is 48 inches wide and 200 feet long, weighing 1,800 pounds. Every variety of vulcanized rubber goods, including the well-known vulcanite emery wheels, can be found at their warehouse, 37 and 38 Park Row, New York.

The Lambertville Iron Works are driving the two remaining Brush dynamo machines with one of their improved steam engines, 12 x 18, making 116 revolutions per minute. This engine is built upon the new plan of overhanging cylinder with heavy bed, has a new style of balanced slide valve and automatic cut-off valve actuated by a common centrifugal governor. It appears to fill the bill of a first-class high speed engine at a moderate cost. Their works are at Lambertville, N. J.

Asbestos has now been put to a great variety of uses, both mechanical and ornamental. It is used for all kinds of non-conducting and fire proof coverings of roofs as well as boilers, steam packing and gaskets of all styles, lining felts and sheathings, paints and cements.

These goods have proved a boon to steam users. All varieties of these articles, as well as the raw and partly manufactured material, are displayed by the pioneer and leader in asbestos goods, H. W. Johns, of H. W. Johns Manufacturing Company, 87 Maiden lane, New York.

The usual fine display of sewing machines is made by E. Remington & Sons, who exhibit their new Remington variety made at Ilion, N. Y., while their type-writer is made at Ilion, Ill.

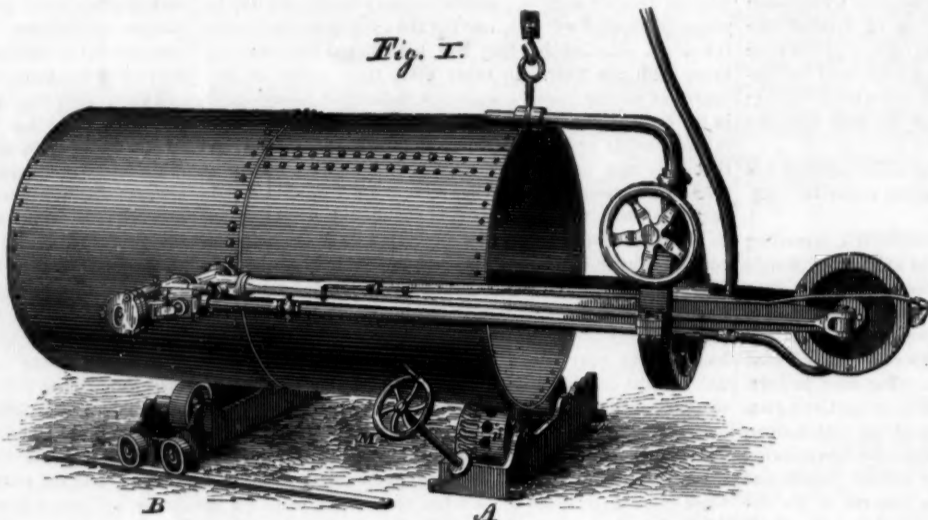
Successful Moving of a Large Hotel.

At a recent meeting of the Engineers' Club, of Philadelphia, the secretary read a detailed description of the moving of the Hotel Pelham, at Tremont and Boylston streets, Boston, for the purpose of widening Tremont street. This hotel is built

of freestone and brick, 96 and 69 feet frontage. The Boylston street wall is supported on eight granite columns 12 feet high, 3 and 4 feet square. There is a basement and seven stories above the sidewalk. Height above tramways on which it was moved, 96 feet. Weight, 5,000 tons, exclusive of furniture, which was not disturbed during removal, as also were not the occupants of the stores on first floor and some of the rooms, the various pipe connections being kept up with flexible tubes. Careful experiments with models showed that if the lower part of the building was firmly braced, there was no danger of shifting in the parts above. The general arrangements consisted of heavy and substantial stone and brick foundations for iron rails and rollers, and the building was forced to its new position by fifty-six screws, 2 inches diameter, half inch pitch, operated by hand against timbers arranged to uniformly distribute the pressure against the building. Much care and ingenuity was displayed in the details of the arrangements and work. Two months and twenty days were occupied in preparation. The moving

itself was begun on August 21, and finished on August 25, but the actual time of moving was but 13 hours and 40 minutes. The greatest speed was two inches in four minutes. The hotel moved about one-eighth of an inch at each quarter turn of the screws. The whole distance moved was 13 feet 10 inches. Four thousand three hundred and fifty-one days' labor was required for the work. The whole cost was about \$30,000. This is the largest building that has ever been removed, although larger have been raised, which latter is a much simpler and less risky operation. The complete success of this undertaking is shown by the fact that cracks which existed in the walls prior to removal were not changed by the operation. Paper was pasted over them before commencing, that any change might be seen.

Fig. I.

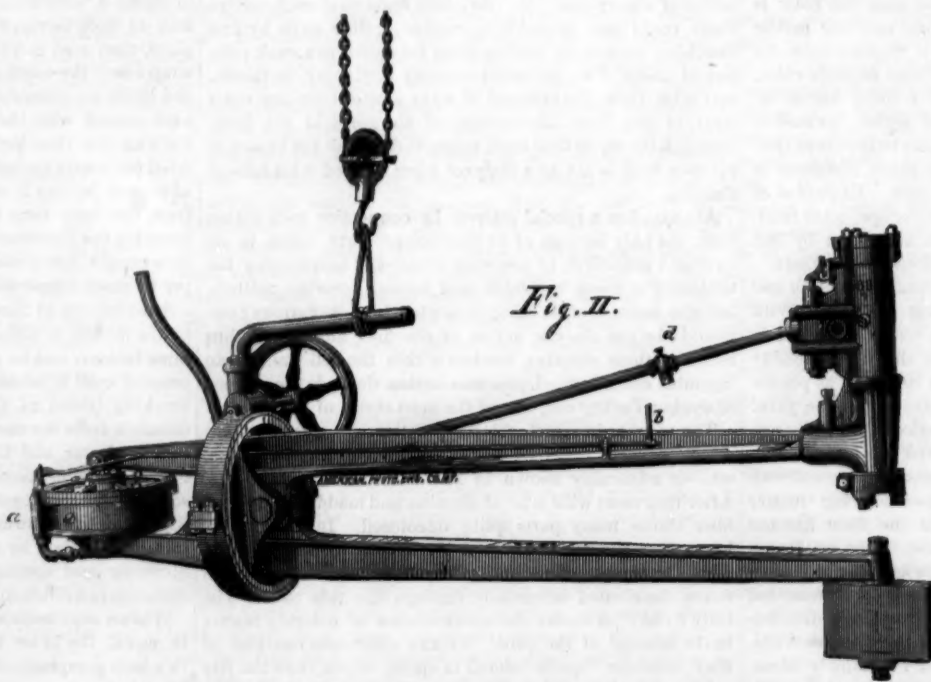
**ALLEN'S PNEUMATIC RIVETING MACHINE.**

mouthful of "hardback." It is manufactured by the well-known Blake Crusher Company, of New Haven, Conn.

The Delamater Iron Works, No. 10 Cortlandt street and West Thirtieth street, N. Y., are exhibiting a fine lot of Ericsson's new caloric pumping engines for domestic use in lifting and forcing water from wells and cisterns, or from Croton pipes to tanks on upper floors of buildings in city or country. They can be operated and attended by any one who can use a cooking stove, and they are as free from dangerous vices as the simplest utensil of the kitchen. They vary in capacity from 200 to 1,600 gallons of water raised to a height of 50 feet.

A sample of the new Otto silent gas machine built by Schleicher, Schumm & Co., 3045 Chestnut street, Philadelphia, is exhibited by their New York agent, A. C. Manning.

Fig. II.

**PNEUMATIC RIVETING MACHINE.—SIDE ELEVATION.**

of 38 Dey street. This engine burns common illuminating gas mingled with common air, and is always ready to start by applying a lighted match. It has lately been much improved, and on account of its cleanliness and safety it is popular as a motor for small power in offices and dwellings.

The Hartford Engineering Company, of Hartford, Conn., builders of the Hartford high speed steam engine, have on exhibition, besides a sample of their engine that drives four of the Brush dynamo machines, a full line of the celebrated Medart belt pulleys. They are made with cast iron spiders or centers and arms, and wrought iron rims, which are riveted to properly formed T-ends of the arms. They are an agreeable departure in mill work, being light and strong, as well as the cheapest pulleys now offered.

ENGINEERING INVENTIONS.

A novel means for raising water from a well, cistern, or other receptacle, and conveying it to a distance and there discharging it, has been patented by Mr. James C. Richardson, of Boscobel, Wis. A wire track, inclining upwardly, is extended from the curb of the well, etc., to the place of discharge, and on this track a carriage, controlled by a rope and windlass, is arranged to run. Connected with this carriage by spring bolts is a bucket carrier, which, on reaching the well, is automatically released, to allow for the descent and filling of the bucket, after which the bucket carrier is raised by the rope and made to automatically engage with the carriage, that is drawn up the track till the bucket meets with a tilting stop, which causes the water to be discharged.

A firing and tamping device for torpedoes, more particularly intended for use in oil wells, but also applicable to wells and drills of various kinds, has been patented by Mr. James E. Gallagher, of Olean, N. Y. The invention consists of a weight designed to be dropped upon the head of the torpedo in the well or drill. This weight consists of a shell of fragile and insoluble material, filled with sand and provided with a solid point, which, striking the head of the torpedo, explodes the latter and causes the sand, that by the explosion and destruction of the shell of the weight is liberated, to be retained in a compact mass above the exploding torpedo, thus tamping the charge and causing it to act laterally.

Mr. James Hays Hagan, of Greenfield, Tenn., has patented an improvement in direct acting engines, in which three pistons are made to reciprocate in a single open-ended cylinder, and are connected with opposite cranks of a double crank shaft.

NEW TOOLS.

Among patents recently issued we find a few tools possessing some points of novelty. The pipe tongs, shown in Fig. 1, are the invention of Mr. N. Purdy, of Fall Brook, Pa. The improvement consists in linking the jaws of the tongs together at their outer ends, and linking one of the jaws permanently to the end of the handle or lever, the other jaw being adapted to be connected to the lever so as to grasp upon the pipe by means of a loop or similar device hinged or pivoted upon the end of the lever, and adapted to be placed over the end of the jaw.

The wrench shown in Fig. 2 has been patented by Mr. W. E. Wild, of Lead City, Dakota Territory. In this wrench the socket is provided with an interior adjustable section for adapting the socket to nuts of different sizes. The movable portion is provided with a rack which is engaged by a worm pivoted at the end of the handle.

An improved expanding mandrel that will hold the work firmly and truly, even under great pressure of the tool, is shown in Fig. 3. The invention consists of a longitudinally ribbed and split sleeve, which is driven into the work and on to a tapered mandrel. This improvement has been patented by Mr. J. A. Wilde, of Hudson, N. Y.

The improved lace cutter, shown in Fig. 4, is the invention of Mr. H. L. Chapman, of Marcellus, Mich. The invention consists in a slotted or split handle having the cutter fastened to its outer end in such a manner that the cutting edge crosses the slot diagonally. Through the slot an adjustable gauge for regulating the width of the lace passes, and can be locked in any desired position by means of the binding screw.

Fig. 5 represents an instrument for opening oysters, clams, and other shell-fish. It consists essentially in a sliding bar actuated by a lever handle and carrying an opening point or knife. An adjustable slotted standard is placed opposite the knife for supporting the oyster or clam. This invention has been patented by Mr. A. Ward, of Brooklyn, N. Y.

Fine Drilling.

Professor Edward C. Pickering, of Harvard College, says that in undertaking to measure the intensity of the light of the satellites of Mars he had occasion to need an extremely small hole. Among the artisans who essayed to furnish what was required was one who had succeeded in making a hole edge-wise through an old fashioned three cent piece, and another who had pierced a needle through from end to end. A hole about the twenty-five-hundredth part of an inch in diameter was finally secured.

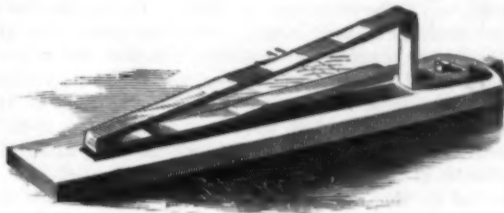
New Use for Buffalo Skins.

An inventor proposes to make machine gear wheels of raw buffalo hide by cementing and pressing together as many layers as are required for the breadth of the wheel. The blanks thus prepared are cut to form the teeth in the usual manner with suitable tools. The advantages claimed are, smooth and noiseless action at very high speeds and greater durability without lubrication.

NEW ORGAN REED.

The engraving shows a double-tongued reed for producing tones in unison or at an interval of an octave or more. The reed block has the usual slot.

The two tongues of this reed are formed of a single strip of metal bent double. One tongue is attached at one end to the reed block, and is raised above the block to give space for vibration of the other tongue beneath. The auxiliary tongue may be a separate piece of metal attached by a rivet.



DOWLING'S IMPROVED ORGAN REED.

The two tongues can be tuned to unison, or the upper reed may be tuned one or two octaves lower than the lower one. The combined tone is much more powerful than a single reed, and of superior quality.

This is the invention of Mr. John H. Dowling, of New Philadelphia, Ohio.

RECENT INVENTIONS.

An improved folding wardrobe bed has been patented by Mr. Ernest N. Doring, of New York city. This bed is so constructed that it will require less weight than heretofore to balance and keep in place. The invention consists in the combination, with the head boards and side boards,

pending the bell detachably, a push rod having its lower end bent to one side, a bell clapper supported from a suspended frame and having a ball and a concave disk at its upper end and a loose head at its lower end, and a standard having a base and having the horizontal upper end slotted to receive the bell handle.

A very compact and efficient hot water generator has been patented by Mr. William W. Goodwin, of Philadelphia, Pa., the same forming a portable heater for use in heating water for bath tubs, basins, etc., as required, or for use in connection with a boiler, for maintaining a supply of hot water, either as a separate apparatus or in connection with gas cooking stoves and ranges. The invention consists in a closely wound water coil inclosed within a double cylindrical casing arranged so that the heated air passes lengthwise of the coil in both directions, and through the outer casing to the escape flue, whereby the heat is utilized to the greatest extent and the water in the coil is rapidly heated. It also consists in a combination with such heater of a hot water reservoir, with which the coil of the generator is connected.

A very useful and complete machine for cleaning, polishing, and assorting nuts, such as pecan nuts, walnuts, etc., has been patented by Mr. Rudolph C. Koerber, of Austin, Texas. In this machine the nuts to be treated are first fed into a cylinder in which is deposited a quantity of gravel, broken stones, or pulverized glass, etc., and the cylinder rotated. By this operation the shells or particles of shells are broken from the nuts, which are thus cleaned. The nuts are then passed into a series of rotating reticulated cylinders, by which they are polished and separated from the gravel, etc., used in cleaning them, and are subsequently delivered down an inclined sieve to a box, from which they are raised by an elevator on to a vibrating sieve, which separates the larger from the smaller nuts. Any number of sieves, both stationary and vibrating, chutes, and receivers, are used to effect a thorough cleansing and extended assortment, according to size, of the nuts.

An improved balance scale has been patented by Mr. Arthur V. Abbott, of Brooklyn, N. Y. In this balance a beam is sustained by one or more flexible metallic strips rigidly attached to the beam and their support.

An improved steam pressure regulator has been patented by Mr. Howell A. Cummins, of Conneaut, Ohio. The invention consists, in combination with a valved steam pipe leading from a boiler, of a lever connected with the valve stem, and weighted at one end with a ball and at the other end with an empty tank or box nearly balanced by the ball. A box or tank containing mercury is connected with the steam pipe outlet and with the lever tank or box by tubular connections, so that when there is an excess of steam pressure in the steam pipe outlet, steam therefrom will enter the mercury tank and force a portion of its contents into the lever tank, thereby drawing down the long end of the lever and closing or partly closing the valve and correspondingly cutting off the steam.

Mr. Ernest W. Noyes, of Bay City, Mich., has patented a spring attachment or boot to be attached to the knees of horses for giving style to the action and gait of the animal, and for increasing his speed, and which at the same time tends to assist the horse in lifting his feet from the ground.

An improved currycomb, patented by Mr. Carey A. Manker, of Red Oak, Iowa, consists in a novel construction of the comb and its handle and the frame and handle of the brush, and a novel mode of connecting the comb and brush, whereby they may be used either alternately or simultaneously, or may be disconnected so as to be used separately.

Mr. Eleazer Ainsworth, of Wilmington, Del., has patented an improved boiler and pipe covering, formed of a layer composed of a mixture of morocco shavings and clay, and two layers composed of a mixture of paper-mill refuse or wood-pulp mill refuse and clay and lime, the layers being held by the wire wrapping.

Mr. Edward B. Ives, of West Point, N. Y., has patented an improved photographic plate holder. The invention consists in a novel mode of constructing the holder by attaching together a number of layers of material.

A hand sawing machine, for cutting trees into logs or lengths, has been patented by Mr. Martin Kurtzman, of Shelby, Ohio. In this machine the saw is operated by a vertically vibrating hand lever, which is connected with the one arm of a bent lever, the other arm of which is provided with a toothed segment. This segment, which works on a lower fulcrum in the frame, gears with a pinion above, the shaft of which operates a crank arm or lever that is pivoted at its lower end to a saw arm or handle. The forward end of this saw arm is slotted to receive the rear end of the saw blade, which is pivoted to the saw arm. The hand lever works up and down between adjustable rubber blocks, which relieve the lever of jar and start it on its return movement.

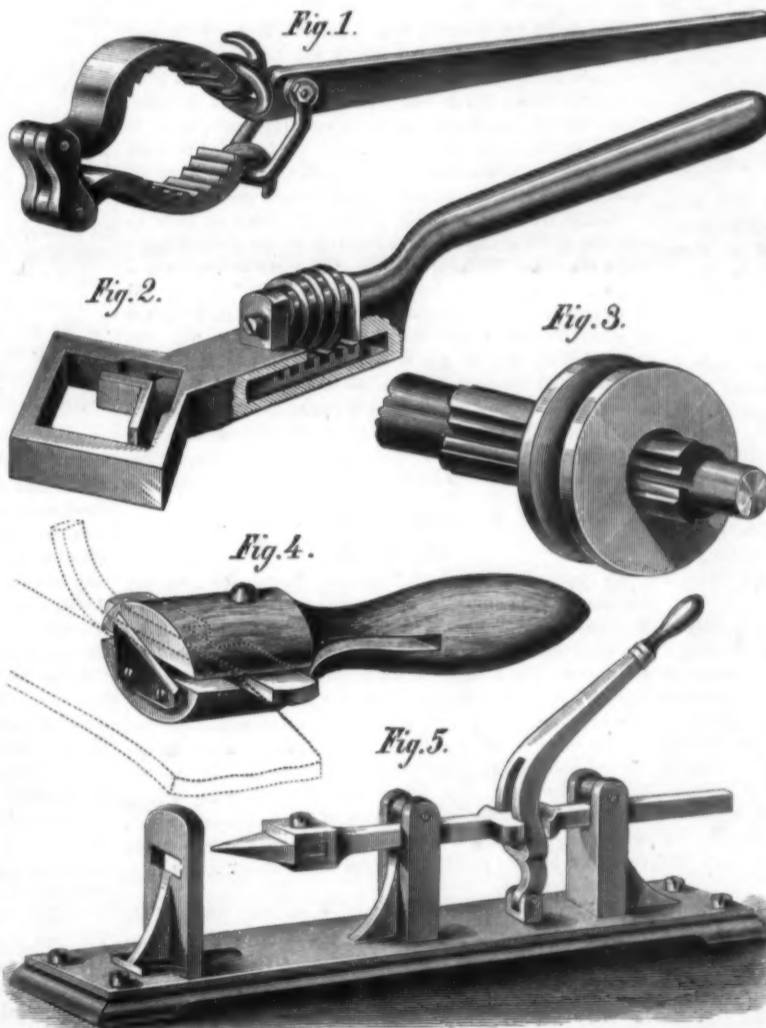


Fig. 1. Purdy's Pipe Tongs.—Fig. 2. Wild's Socket Wrench.—Fig. 3. Wilde's Expanding Mandrel.—Fig. 4. Chapman's Lace Cutter.—Fig. 5. Ward's Oyster Opener.

RECENTLY PATENTED TOOLS.

of curved friction bars pivoted at their lower ends and having their upper ends pressed forward by springs, whereby the pressure of the springs and curved bars against the ends of the sideboards will assist to keep the sideboards in any desired position.

Mr. George Derby, of New York city, has patented an improved mill burr which is in construction durable, and can be easily sharpened.

Mr. Thomas Aitken, of Pittston, Pa., has patented an improved coal drilling machine which is light, compact, and easily transportable, easy of adjustment, and will hold more securely in position for work.

An improvement in gong bells has been patented by Mr. Asa G. Golding, of New York city. The invention consists in constructing a gong bell with a handle attached to the bell, and having a neck, a shoulder, and a flange for sus-

OUR GRAIN CROP AND ITS COMMERCIAL IMPORTANCE.

[Continued from first page.]

decade; in the preceding decades the gain was 66 and 60 per cent. Seven-tenths of the entire crop last year was produced in Illinois, Indiana, Ohio, Michigan, Minnesota, Iowa, California, Missouri, and Wisconsin. The products of these States were, in round numbers: Illinois, 51,000,000 bushels; Indiana, 47,000,000; Ohio, 46,000,000; Michigan, 35,500,000; Iowa, 31,000,000; California, 29,000,000; Missouri and Wisconsin, each 25,000,000. Pennsylvania followed with 19,500,000 bushels; Kansas, 17,000,000; Nebraska, 14,000,000; New York and Kentucky, each 11,500,000. The home consumption of wheat is about 300,000,000 bushels.

The great corn-growing States are: Illinois, 326,000,000 bushels; Iowa, 275,000,000; Mississippi, 200,000,000; Indiana, 115,000,000; Ohio, 112,000,000; Kansas, 106,000,000; Kentucky, 78,000,000; Nebraska, 66,000,000; Tennessee, 63,000,000. Far below in the scale of productions are the following, the figures standing for millions of bushels: Pennsylvania, 46; Wisconsin, 34; Michigan, 32; Virginia, 29; Texas, 29; North Carolina, 28; New York, 26; Alabama, 25½; Arkansas, 24; Georgia, 23; Mississippi, 21.

The oat crop comes mainly from Illinois, 63,000,000 bushels; Iowa, 50,500,000; New York, 37,500,000; Pennsylvania, 34,000,000; Wisconsin, 33,000,000; Ohio, 28,500,000; Minnesota, 23,500,000; Missouri, 21,000,000; Indiana, 15,500,000. Four-tenths of the area of this crop and nearly half the total product are accredited to the first four States named.

Of the barley crop California and New York produce nearly one-half, and Wisconsin, Iowa, and Minnesota yield most of the other half. About half the rye crop comes from Pennsylvania, Illinois, and New York. Of the buckwheat crop (about 12,000,000 bushels) two-thirds are produced by New York and Pennsylvania.

The enormous and wonderfully rapid increase in our grain crops is attributable to several causes. Primarily we have the invention and improvement of agricultural machinery, by which the cultivation of the great West has been made possible. Next we have the vast extension and improvement of our railway and water lines, making possible the profitable transportation of the large surplus to Eastern and foreign markets. With this extension of means has come an important lowering of freight charges, which has made it possible to place American grain in the markets of Europe at prices at which it can compete successfully with European grain, especially that from Russia, Hungary, Austria, and Germany.

Of course the vast immigration of farmers who have swarmed into the Northwest, a full regiment a day for every day in the year, is an element of the problem of no mean significance, but their labor has been largely invited and made profitable by the cheapening of the transportation of their crops to the East and to Europe.

Ten years ago it was the belief of railroad men that grain could not be carried from Chicago to New York for less than 24 cents a bushel. The rate has since been lowered to 20 cents, and for special rates, it is said, on good authority, to half that sum. The nominal rate at this time is 17 cents. During the same period the cost of water carriage has been correspondingly reduced. The lowest estimate that we have seen of the actual cost of bringing wheat from Chicago to Buffalo by steam barge is \$2.85 a hundred bushels; from Buffalo to New York by canal and river, \$5.70; making the cost from Chicago to New York by water (all charges included), 8½ cents a bushel.

Ten years ago it cost nearly as much to get a bushel of grain from Buffalo to New York as it now does to carry it from Chicago to Liverpool. The influence of a reduction of a cent a bushel in transportation charges would be incredible if we did not know how narrow is the margin of profit in the handling of great staples. The reduction of one cent in the Erie Canal tolls was followed by an increase in grain carriage from 29,000,000 bushels to 69,000,000 of bushels. In a recent Legislative inquiry a prominent grain merchant expressed the belief that the abolition of the remaining one cent toll would increase the flow of grain through the canal to 150,000,000 bushels a year.

Something over half of the entire export grain trade of the country is done at this port, where the elevators and great warehouses have a storing capacity of nearly twenty-five million bushels. A very large part of the grain passing through the city, however, is loaded directly from the canal boats into the ocean steamers, as shown in our illustration. Commonly the loading and unloading go on together, a floating elevator hauling alongside and pouring in the grain as fast as the outgoing freight is removed. Usually the canal boats carry from five to seven thousand bushels or more, four of them sufficing to load a grain ship, and eight to ten a large steamer. The largest cargo ever brought through the canal was recently reported; it was 8,500 bushels. The largest grain steamer will carry 150,000 bushels; from 80,000 to 90,000 bushels is a large cargo.

To carry our entire grain crop would require from thirty to fifty thousand large steamers; or something like half a million canal boats, or a train of freight cars over thirty thousand miles long! To carry away as wheat our exports of wheat and flour would require five thousand vessels carrying the average cargo of 30,000 bushels each. It is only by figures like these that one can make any approach to a definite idea of the magnitude of the grain trade, or its enormous influence upon the world's commerce.

Though not intended specially for the grain trade, the huge steamer, the City of Rome, shown at the bottom of

our first page illustration, will, no doubt, prove an important factor in its future development. This steamer ranks next to the Great Eastern in size, and is the largest vessel in the merchant service. Her dimensions are as follows:

Length of keel, 546 feet; length over all, 590 feet; breadth of beam, 52 feet; depth of hold, 38 feet 9 inches; and depth from top of deck house to keel, 52 feet. Her tonnage is 8,300, being over four-fifths that of the Great Eastern. The leading particulars of the engines are as follows:

There are three high pressure cylinders 43 inches in diameter, and three low pressure cylinders 86 inches in diameter, and 6 feet stroke. The diameter of the crank shaft is 25 inches, and of the crank pins, 26 inches. The length of the main bearings is 33½ inches, and of the crank pins 28 inches. The crank shaft, as built up complete, will weigh 64 tons; had it been made of iron, and solid, the weight would have been 73 tons. The propeller shafting is 24 inches in diameter, and the hole through it 14 inches in diameter. The thrust shaft has thirteen collars 39½ inches in diameter, giving a surface of 6,000 square inches. This piece of shafting weighs 17 tons. The propeller shaft is 25 inches in diameter and 30½ feet long, and weighs 18 tons. The engine bed plate weighs 100 tons. The cooling surface of the condensers is 17,000 square feet, equal to nearly 17 miles 360 yards of tubing.

There are two air pumps 39 inches in diameter, and 3 feet stroke; these pumps, and the feed and bilge pumps, being worked by levers attached to the aft and forward engines. There will also be a large centrifugal pumping engine, which can either be used for pumping heavy leaks, or to discharge through the condenser. There will also be three auxiliary pumping engines, for feeding the boilers, for bilge pumping, and for deck purposes. Steam will be supplied by eight cylindrical tubular boilers, fired from both ends. Each boiler is 14 feet mean diameter and 19 feet long, with a steam receiver 18 feet long and 4 feet in diameter, and has six furnaces 3 feet 9 inches in diameter, three at each end, so that there are forty-eight furnaces in all. The fire bars are 6 feet long, giving a grate surface of 1,080 square feet. The shell plates of the boilers, supplied by Sir John Brown & Co., are 24 feet 8 inches long, 4 feet 4½ inches wide, and 1¼ inches thick, and weigh nearly 2½ tons each; all the holes are drilled. The internal parts are of Bowling iron, and each furnace has its own separate combustion chamber. These boilers are constructed for a working pressure of 90 pounds per square inch. The engines are intended to work constantly at 8,000 indicated horse power, although they are capable of developing 10,000 indicated horse power.

Though built for a speed of over 17 knots an hour, or over 400 miles a day, the maiden trip of the great steamer was a slow one. Three stoppages of importance were necessary during the voyage, owing to the machinery. On the first night out from Queens-town the journals grew too hot to continue, and a two hours' stop was necessitated. On the following day the reversing gear of the engine got out of order, and for sixteen hours the monster vessel lay to in a rough sea, rolling heavily. Afterward the steam steering gear became deranged, and two hours more were lost while the engineers worked at it. Stoppages excluded, the voyage across the Atlantic was made in eight days and twenty-two hours.

INVENTIONS.

An improvement in boiler furnaces, having for its object the complete combustion of the fuel and gases in the fire boxes of steam boilers, evaporators, etc., has been patented by Mr. John Mailer, of San Francisco, Cal. The door of the furnace has a series of air passages through it, and the lining of the door is also made with a series of perforations, in which are inserted short stout metal tubes that project inward toward the door front. These tubes become highly heated and elevate the temperature of the air passing through the door. The bridge wall of the furnace is likewise provided with several rows of perforations, through which the smoke and gaseous products of combustion are restricted in their passage from the fire chamber to the combustion chamber.

Mr. John H. Blake, of Batavia, N. Y., has patented an improved cut off valve gear. The invention consists of two slide valves, one at each end of the cylinder, each having a separate steam chest, into which steam is admitted throughout the whole stroke of the engine, the point of cut-off being regulated by rotary valves that are placed in supplemental steam chests over each slide valve; and it consists, further, of a hydraulic cylinder designed to be operated by water under pressure, provided with suitable valve and piston, which cylinder forms the connection between the governor and rotary or cut-off valves, and facilitates and regulates the action of the latter. The mechanism for operating the valves and the rotary valves are of peculiar construction, and among the advantages attained by this system of governing are the retention of the cut-off at any point it may have assumed, the slight strain thrown upon the governor, great sensitiveness of the latter, and nicety of adjustment to any point of cut-off desired, also the prompt and decided action of the cut-off devices.

Mr. Adam R. Reese, of Phillipsburg, N. J., has patented a machine for quarrying slate and other rock. The object of this invention is to avoid that excessive waste of the rock, labor, and expense which is attendant upon the ordinary methods of quarrying, by the use of an improved machine for sawing and cutting the rock *in situ*. This machine is provided with a reciprocating travelling carriage having

rotary saws or cutters for effecting the cut of the rock. The carriage is supported on a frame furnished with vertical screw threaded and sharp pointed legs for the purpose of adjusting the frame to different inclinations or levels. Screw adjustments also are provided for shallow or deep cutting by the saws. The machine is organized for cutting parallel channels in the slate or rock, and the saw teeth cut upward, so that the power applied to the cutting shall operate to hold the machine more firmly down in position. An engine is mounted on the frame for operating the mechanism which transmits the necessary motion to the saws, but it is designed that the motive agent, which may be steam, compressed air, or gas, shall be furnished by suitable metal pipes and flexible tubes from a source which is independent of the machine.

Mr. William Crye, of Walla Walla, Washington Territory, has patented an improvement in middlings purifiers. The object of this invention is to keep free and clean the screens of middlings purifiers used in the process of manufacturing flour. To this end, the screen of the purifier has combined with it a reciprocating brush frame, the brushes of which act upon the underside of the screen. A rotating double-threaded rod, working in a double-threaded nut, gives the necessary reciprocating action to the brush frame, the nut being tilted at the end of each stroke for the purpose of engaging and disengaging alternately with the right and left hand threads on the rod.

Mr. Richard H. Atwell, of Baltimore, Md., has patented a spray motor, which is not restricted to a mere construction of parts, but includes a valuable principle of action. The invention consists in a method of increasing the effective power of rotary jet motors by commingling a gaseous and liquid medium to form a spray, and directing this spray against the periphery of a wheel or moving interior portion of the motor. Various kinds of gas may be used in concert with water to form the spray, and either the gas or liquid be energized. In either case it is claimed that a greatly increased result is obtained over or as compared with the use of air or gas alone or a liquid alone as the impelling agent. The invention also consists in certain constructions of different parts of a rotary jet motor for advantageously carrying the above principle into effect, the same including an inlet for a liquid medium and an inlet for a gaseous medium having a confluence at or before the point of impact against the wheel; also a wheel against which the spray acts formed of a disk with angular buckets projecting from the side of the same.

Mr. James D. McAnally, of Waterloo, Ind., has patented an improved harness catch and cockeye for whiffletrees, etc. This invention, which is equally adapted for use upon neck yokes, bridle bits, water hooks, and in fact upon all parts of a harness where catches are desired, consists in a ferrule having an outwardly or inwardly opening catch, clipped away on its under side, in combination with a vertically inserted cockeye, capable of ready engagement and disengagement, and having its pintle protected from dust.

The Longevity of the Ancients.

Can man reach and pass the age of a hundred years? is a question concerning which physiologists have different opinions. Buffon was the first one in France to raise the question of the extreme limit of human life. In his opinion, man, becoming adult at sixteen, ought to live to six times that age, or to ninety-six years. Having been called upon to account for the phenomenal ages attributed by the Bible to the patriarchs, he risked the following as an explanation: "Before the flood the earth was less solid, less compact than it is now. The law of gravitation had acted for only a little time; the productions of the globe had less consistency, and the body of man, being more supple, was more susceptible of extension. Being able to grow for a longer time, it should, in consequence, live for a longer time than now."

The German Heusler has suggested on the same point that the ancients did not divide time as we do. Previous to the age of Abraham the year, among some people of the East, was only three months, or a season; so that they had a year of spring, one of summer, one of fall, and one of winter. The year was extended so as to consist of eight months after Abraham, and of twelve months after Joseph. Voltaire rejected the longevity assigned to the patriarchs of the Bible, but accepted without question the stories of the great ages attained by some men in India, where, he says, "it is not rare to see old men of one hundred and twenty years." The eminent French physiologist, Flourens, fixing the complete development of man at twenty years, teaches that he should live five times as long as it takes him to become an adult. According to this author the moment of a completed development may be recognized by the fact of the junction of the bones with their apophyses. This junction takes place in horses at five years, and the horse does not live beyond twenty-five years; with the ox, at four years, and it does not live over twenty years; with the cat at eighteen months, and that animal rarely lives over ten years. With man it is effected at twenty years, and he only exceptionally lives beyond one hundred years. The same physiologist admits, however, that human life may be exceptionally prolonged under certain conditions of comfort, sobriety, freedom from care, regularity of habits, and observance of the rules of hygiene, and he terminates his interesting study of the last point ("De la Longévité Humaine") with the aphorism, "Man kills himself rather than dies."—*M. De Solville, Popular Science Monthly*.

Correspondence.

Small Motor Wanted.

To the Editor of the Scientific American:

It is a marvel that no one has yet invented a moderately sized machine for working punkas in India. Each room in three-fourths of the stations of this country has its punka worked by a cooly, and the annual cost of these men, whose pay varies from three to six rupees (\$1.50 to \$3) a month, is enormous. In large establishments, such as barracks, of course, very many are required, but in private houses, too, they may often be counted by the dozen.

Not only are they very expensive, but they are at the same time, in nine cases out of ten, very useless, and many are the sleepless nights passed by the hapless European, due solely to the cooly, whom it is impossible to keep awake. The moment the punka stops, not only does the heat become oppressive, but bloodthirsty mosquitoes in myriads swoop down on the unfortunate victim. He then, who would invent a simple machine to work a punka that could be regulated by the owner himself and render him independent of the drowsy cooly, would not only confer an unspeakable blessing on the Anglo-Indian community, but would also make an enormous fortune commercially, for once let their value be known they could not be made quickly enough.

In some barracks and hospitals there are already punkas worked by steam, but it is not these we want; it is a common, simple machine that could, if necessary, be moved from room to room. As the resistance offered by a small punka is very slight, it would require no very powerful mechanical contrivance to work one for eight hours, say, before it required fresh adjustment.

If you will publish this far and wide through your valuable columns, it may lead to some invention that will at once secure a fortune to the inventor and prove an inestimable boon to the sufferers who are dependent upon drowsy, frail, human machines for their comfort and repose.

F. W. MAJOR.

Calcutta, September 5, 1881.

REMARKS.—A machine such as our correspondent describes is wanted almost everywhere. Its invention would be of great value. We will offer a few suggestions to those who may wish to study the subject. The punka referred to consists of a large fan suspended from the ceiling of the apartment and operated by a rod which the attendant pushes back and forth. To work a punka so as to produce a sensible effect in the hot climate of Calcutta requires the exercise of a force equal to about one-tenth of a horse power. To the majority of people it looks as if this small force might be easily applied by a coiled spring or a weight. Let us try the weight. How large a one is needed? For a full horse power a weight of 33,000 pounds descending one foot in a minute is required. To drive a punka, therefore, one-tenth of the above, that is, a weight of 3,300 pounds descending one foot, will do the business for one minute. To make it run ten minutes the weight must be wound up ten feet high, or six winds an hour. In the household so weighty a machine would be cumbersome. Springs would occupy less space, but they would still require to be pretty heavy and must be frequently wound. If our correspondent has gas he can readily obtain a small gas motor which, on a consumption of six cubic feet per hour, will drive one punka. Next to that probably the best motor would be water. A tank filled with water eleven feet square and same depth, placed twenty feet above ground, if allowed to discharge its contents in a suitable manner upon a small wheel at the ground, would drive a punka for eight hours. The water must then be pumped up again into the tank. There is no royal way to realize mechanical power. It is simply the lifting of a dead weight, either by turning a wheel or working a pump, or carrying water upstairs in buckets, or using the power of the wind, running streams, or a combustion of fuel.

The Influence of Atmospheric Pressure on Earth Currents and Mine Gases.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of October 22, there was an article referring to some observations, which, if correct, establish the influence of atmospheric pressure on the flow of springs. This recalled to me a fact observed years ago, and which strikingly exhibits a consequence of an increase or decrease of this pressure that we do not usually think of.

I used to live in Switzerland. Years ago a gentleman of my acquaintance attempted to dig a well. The ground proved to be sand and gravel to a depth of 93 feet, when at last water was found. The well was walled in in the usual fashion and a force pump set in. But soon the water disappeared. The well was deepened again, until at a depth of 115 feet water was reached again. But as the nature of the soil continued the same this water also soon disappeared, and the well was therefore given up and covered over. Soon after a remarkable phenomenon was observed. At certain times a violent wind would blow from the well, so strong as to blow a handful of straw held over it eight or ten feet in the air. At other times the current would run in the opposite direction. Soon it was observed that a change of direction in the current of air would precede a change of weather: an upward current came to mean rain, a downward direction fair weather. The well was consulted a good deal by the neighboring farmers, especially in haying and harvest time, and proved a very sensitive barometer. Of course

the explanation suggested itself at once. A decrease in the pressure of the atmosphere would release a great quantity of air pent up under the previous higher pressure in the extremely porous soil, for which this well proved a convenient drain. The opposite would take place under an increasing pressure, i. e., during a rise of the barometer.

About a year ago or more, there appeared in the *Nineteenth Century* an article by Mr. Plimssoll, discussing the possibility of preventing explosions in the coal mines, an article which elicited several others on the same subject. In Mr. Plimssoll's article the well known fact was alluded to that during a low pressure of the atmosphere the air in the mines was much worse than when the barometer stood high. The cause of this is usually assumed to be a less free circulation of the air. Would not the above mentioned observation on the well suggest another cause—an enormously increased discharge of carburated hydrogen gases under a lower atmospheric pressure?

The same thing must take place over very large areas every time when the barometer indicates low atmospheric pressure. A good deal of the air escaping from the ground must be miasmatic in its nature. Pettenkofer's investigations leave no doubt of this. Would not this account also, in some degree, for the rather languid feeling that is very prevalent whenever a low barometer prevails over a large area for any length of time?

J. J. SCHOBINGER.

Chicago, October, 1881.

The Deadly Fly in Texas.

To the Editor of the Scientific American:

In your paper dated September 24, page 190, I was much interested in the report of a disease produced by a "deadly fly," the *Calliphora anthrophophaga*, found by Conil in the Argentine Republic; and so similar in many particulars to the fly, the worm (larvæ), and the disease produced by it, as well also as its favorite habitat, to the similar, if not identical fly, the stock pest of our summer and fall months here, that I may be excused for sending you a hastily written report of a case which occurred in my practice, selected from among others treated only on account of a hidden pathological condition which it seems possible may have been revealed through the agency of the worm.

At the time the article was written no volume of reference was at hand, by which I could give the systematic name, and hence reported it from an unsatisfactory standpoint, using the vulgar name, the one by which it is known here, "screw worm."

From the very great resemblance of the illustration in your paper to the Texas "screw worm" and also the parent fly, I am inclined to think they are identical.

My own impression is they are deposited prehatched, as they attain their full growth and size by the fourth or fifth day, which is probably three-eighths to half an inch in length instead of five-eighths, as mentioned in the report.

It is singular that they seem confined to the trans-Mississippi, and, I believe, south of the 34th or 35th parallel.

Accompanying this note I forward you the report mentioned.

T. H. CLARK, M.D.

Reagan, Falls Co., Texas, October, 1881.

We have received the report mentioned by Dr. Clark. The account of the case that occurred in his practice in 1878 is very interesting, and corresponds closely with the description he refers to in our paper of September 24, concerning the Argentine fly. We think that there have been instances of loss of life in this city from the bites of a fly that hovers about the hides that come from Buenos Ayres.

Dr. Clark's report was published in the *Virginia Medical Monthly* for June, 1879.

Painting of Cement and Plaster.

Much difference of opinion prevails respecting the question of painting Portland cement, and we have seen work painted a few weeks after the cement has set, which has stood well. There is one point which has a great deal to do with the question of successful painting, namely, the absorbency and dryness of the brickwork itself. Many new walls, saturated with moisture, are cemented, and in this condition no paint can possibly stand if laid on too soon. It is a good and safe rule to enforce that Portland cement work should not be painted within a year of its completion, to allow it to dry thoroughly; but we are safe in saying the majority of new fronts are painted before they have been finished three months. A very desirable precaution seems to be to coat the work with linseed oil first.

The painting of plaster work requires the same care, and the lime works out in small bubbles, destroying the paint. In painting plaster, white lead and linseed oil, with a little drier, is recommended by one authority. This coat should be of the consistence of thin cream, so that the oil is absorbed into the plaster in a few hours. In a day or two another thicker coat may be applied, and a third a few days after rather thicker, followed by the finishing coat. Four coats are not too much for good work. By the absorption of the oil into the plaster the surface becomes hardened, and may be washed. Another method to facilitate this absorption is followed by painters, which is to give the plaster two or three coats of boiling linseed oil, and then to apply the other coats of paint. We are inclined to think the application of the oil before the paint a better plan, to insure a thorough saturation of the material. The color of Portland cement, and the uneven tints it sometimes assumes, is the main reason why painting it is resorted to. For this reason we think it may be worth the attention of manufacturers to

turn their consideration to the subject, and those using cement as a stucco might also prevent a blotchy and uneven tint by attending to the preparation of the wall and the sand they use with the cement.—*Building News*.

AGRICULTURAL INVENTIONS.

Mr. Ashley E. Armstrong, of East Claridon, Ohio, has patented an improved conductor tube for grain drills and fertilizer distributors, so constructed that the plows can adjust themselves to uneven land, and can rise to pass obstructions without disarranging the tubes or interfering with their proper operation.

An improved stalk rake has been patented by Mr. Henry Grebe, of Omaha, Neb. This rake is intended for gathering cornstalks and other stalks and rubbish into windrows, to facilitate the preparation and cultivation of the land.

An improved sulky harrow has been patented by William Hannum, of Mount Gilead, Ohio. The invention consists of a harrow composed of two wings or sections hinged to each other, provided with guide rods and suspended from the axle, and three independent shafts journaled in standards secured to the axle, and provided with levers and eccentrics carrying chains secured at their lower ends to the harrow sections, near their outer and inner edges, whereby the central portion of the harrow or either harrow section can be raised or lowered independently of the other section to avoid obstructions, or both sections can be raised or lowered when desired.

An improved cornstalk loader has been patented by Mr. Peter C. Schlechtman, of Arlington, Wis. This invention consists of a derrick of peculiar construction operated by a long lever and cords and pulleys.

A machine for splitting and breaking cornstalks has been patented by Messrs. Jacob Behringer, of Bowmansdale, William Stouffer, of Dillsburg, and Joseph R. Potts, of Mechanicsburg, Pa. In this machine the cornstalks to be operated on are passed in between a pair of feed rollers, to and over a stationary breaking bar, where they are first split by the action of a revolving winged cylinder of knives, and subsequently broken down across the edge of the bar by the wings or arms of the cylinder. The split and broken cornstalks can be handled by a fork with as much ease as hay or straw; they form better feed for cattle than when whole or merely cut crosswise; and the refuse stalks will be much sooner converted into manure.

A pulverizing attachment for plows has been patented by Mr. Tapley B. Maddux, of Denton, Texas. The object of this invention is to pulverize furrow slices as they are turned by plows; and it is particularly designed to lessen the draught in such devices by arranging the cutters at the top of the mould board in such manner as to offer but little resistance to the passage of the furrow slice. To this end the curved mould board of the plow has a bar secured to its upper curved edge, on which bar are fastened a series of cutters arranged to project upward and inclined or curved to the rearward, also formed with shoulders which rest upon the mould board. The cutters are sufficiently long to reach through the furrow slice.

Mr. Armand Richard, of Grand Coteau, La., has patented an improvement in plows, in which provision is made for adjusting the blade of the plow, as it wears, by loosening a clamp bolt and removing the teeth of a clamp from notches in a flange with which they engage, after which the blade may be set further forward. The clamp bolt does not pass through the cutting blade, consequently the latter is not weakened by a hole for the bolt.

The Panama Canal.—Work Done.

The president of the American Branch of the (De Lesseps) Panama Canal Company has issued a statement of the condition of the work. Notwithstanding the obstacles encountered in the luxuriant vegetation and the thick forests, there has been opened and recorded transversely to the axis of the canal over 200 kilometers of paths, and also a passage from 20 to 30 meters has been made from one end of the Isthmus to the other, according to the proposed lines of the Canal Commission. For meteorological studies, to which especial attention has been given, four stations have been established—at Colon, Gamboa, La Boca del Rio Grande, and Naos Island. Geological surveys have been made and are now in progress. It has been ascertained that between Colon and Lion Hill the canal will not encounter any rocks. At the present time two steam sounding apparatus are being put up similar to those at Colon. At this station the samples brought up by the spoons have given an exact structure of the soil. It is shown to be a succession of layers of clay, representing the degradations of a greenish pyroxenic rock, which through its gradual degradations and decomposition has produced this formation. At other places the ground, bored to a depth of 25 meters, has revealed nearly every way, instead of successive formations methodically arranged, a chain of derived rocks growing softer and softer. The thickness of the mellow soil is quite remarkable, and, in a word, the soundings have given results beyond expectation on the whole line of the canal.

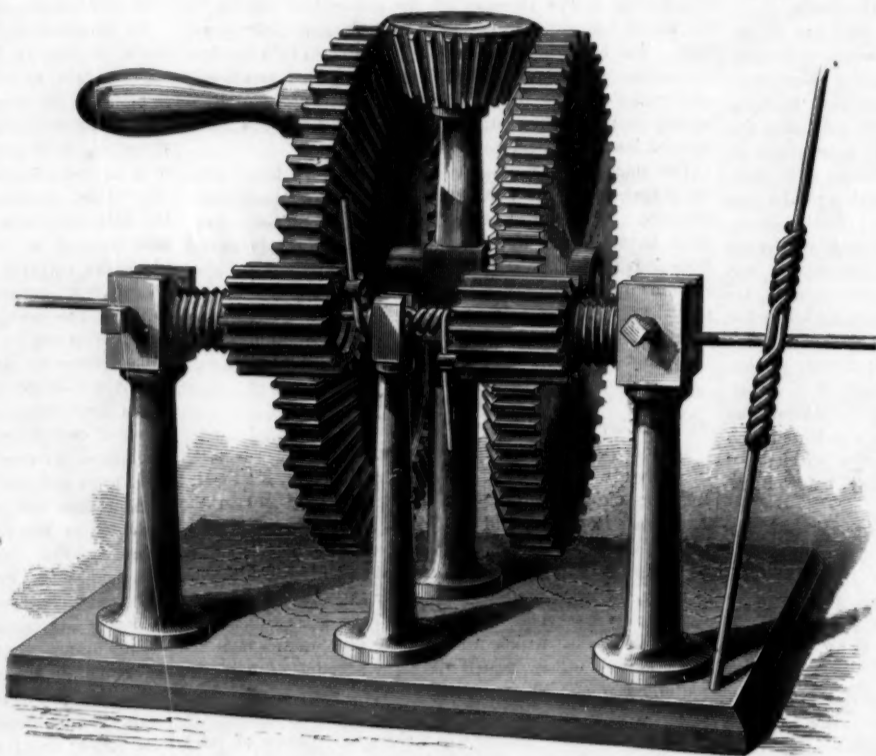
Work on the canal has been commenced. The company now have 200 cars, 12 locomotives, 2 pontons, 2 steam cranes, 18 flatboats, 2 dredges with change pieces, ribbon saws, rails, etc., a part of which is already at Colon and the remainder is on the way. The storehouses at Colon cover an area of 1,400 meters, and are full. Five barges and two steamboats are plying upon the Chagres River. Another steamboat at Panama is used for hydrographic surveys of the bay.

TELEGRAPH WIRE JOINTER.

The engraving shows a simple and compact machine for quickly joining the ends of telegraph wires. Two standards fixed opposite each other on the base support two horizontal screws extending inward toward each other. A groove, extending the whole length of each screw, is cut through its upper face as far as the axis for receiving the ends of the wires that are to be jointed. Upon each screw there is a pinion also slotted to admit the wire and provided with a stud on its inner end. These two pinions are engaged by two spur wheels turning loosely on the same axis and having beveled cogs formed on their adjoining faces.

The beveled portions of these wheels mesh into a bevel wheel supported on a bearing between them, so that when one wheel is revolved in one direction the other will move in the reverse direction. This results in turning the pinions in opposite directions and twisting the ends of the wire one around the other in opposite directions.

The wires to be jointed have their extremities bent at right angles. They are then laid in the slots of the screws through the slots of the pinions, which, acting as nuts, are run in opposite directions toward the standard. The bent end of each of the wires takes against the stud which projects from the inner end of the opposite pinion, and so that the wires overlap each other within a slot in the top of the standard placed between the two screws. The drive wheels are then turned by means of the handle, revolving the pinions in opposite directions, so that they move from each other. By this means the ends of the wires are twisted about each other in exact imitation of hand-jointing, as shown in the view of the section resting on the machine. This invention has been patented by Messrs. F. and J. A. Crich, the former of Johnstown, Pa., the latter of Naugatuck, Conn.

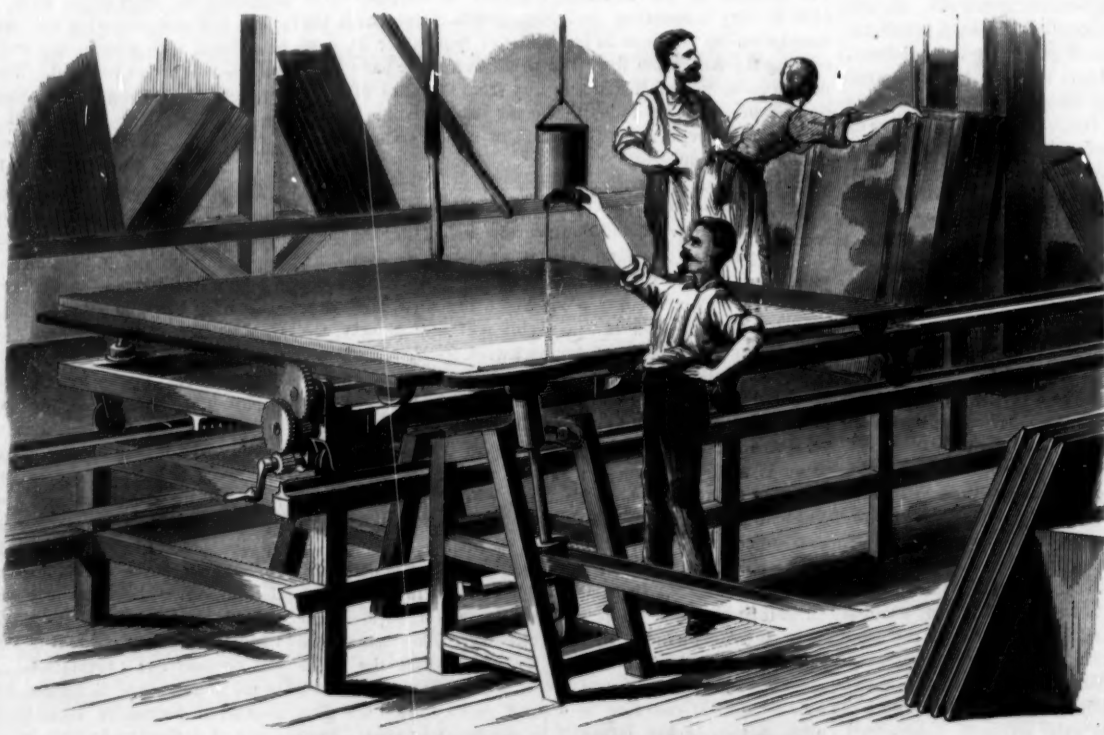


TELEGRAPH WIRE JOINTER.

PLATE-GLASS BEVELING MACHINE.

The engraving represents an improved machine for beveling and polishing the edges of plate glass. It is capable of making a bevel of any width or inclination, and it does it very rapidly and perfectly. The table upon which the glass plate to be beveled is placed, is supported upon a series of eccentric wheels mounted on a shaft passing along that edge of the table adjoining the grinding wheel. These eccentrics can be rotated gradually by means of geared wheels so as to raise or lower that edge of the table; the opposite edge of the table resting upon ball-and-socket joints. The grinding wheel of iron is mounted on a shaft which rests in a swiveled bearing which permits of the inclination of the shaft to the desired bevel.

The table on which the glass plate rests is movable lengthwise along a track which is double the length of the table. After placing the glass plate upon the table, the eccentric shaft is rotated until the longest radius of the eccentrics extend upward. The grinding wheel shaft is inclined more or less until the inclination of the wheel is the same as the angle of the desired bevel. If a very flat bevel is desired, the grinding wheel and its shaft are but slightly inclined; but if a steeper bevel is required, the inclination of the grinding wheel will be increased. The grinding-wheel having been adjusted, the power is applied, and the table-moving mechanism is made so that the motion of the table is reversed at the end of each trip of the table. The edge of the glass plate is drawn over the grinding disk, to which is applied the abrading or polishing material. After a certain time the edge of the plate will have been ground off to such an extent that the grinding wheel cannot attack or abrade it; the eccentric shaft is then rotated more or less, as may be necessary, adjusting the front edge of the table and of the glass plate resting on it, as may be required. This invention was recently patented by Mr. Dominique Durand, of Mamaroneck, N. Y.



DURAND'S PLATE-GLASS BEVELING MACHINE.

that cellulose, lignin, peat, lignite, coal, and anthracite are terms of an infinite series specialized by the conditions of their formation.—*Jour. of Gas Lighting.*

NEW INVENTIONS.

An improved telegraph key has been patented by Mr. Addison E. Peterman, of Handsborough, Miss. This invention consists in a spring lever key of novel construction and arrangement, the object being to obtain uniform tension

with ease in working, and to avoid the objections that exist to the use of a lever and separate spring.

Mr. George Andrews, of Bellows Falls, Vt., has patented an improved and durable belt to be used on all machines that employ narrow or round belts. The invention consists of a belt formed of a core of some strong material, preferably catgut, wound with strong wire.

Mr. Nicholas B. Denny, of Singapore, Straits Settlements, British India, has patented an improved oil can tip. The object of this invention is to prevent waste from oil cans in oiling machinery; and the invention consists in a spring actuated tip applied to an oil can tube for closing the outlet.

An improvement in the manufacture of paper, patented by Messrs. Nicholas G. Richardson, of Tyaquin Moniven, County of Galway, and William Smith, of Golden Bridge Mills, county of Dublin, Ireland, consists in the employment of a new vegetable substance combined with other substances now used in the manufacture; or such vegetable substance can be used alone to make from it, by the aid of the usual appliances or apparatus, a pulp from which the paper is made. The vegetable substance used is *Melinaeae carulea*, otherwise *Melica carulea*, commonly known as "melic grass." This grass is converted into pulp or half-stuff, and the same can be, by the usual appliances or apparatus, converted into paper, or such substance as may be combined with any of the substances usually employed in the manufacture of paper.

Mr. Henry G. Dennis, of New Bedford, Mass., has patented an improved bell joint for coupling pipes. The invention consists in a rabbeted collar mounted on the end of a pipe and resting against an annular bead near the end of the same, which pipe is swaged out to receive the contracted end of the other pipe, upon which molten lead is poured through an aperture in the top of the collar to fill the space between the inner surface of the collar and the pipes, a clay roll having been previously placed against the open end of the collar.

An improved process of distilling alcohol has been patented by Mr. Charles W. Lawrence, of New York city. The process consists in charging the still with spirit-producing material and powdered charcoal in about the proportions set forth, then stirring and heating the mass by steam, as shown, whereby the operations of distilling and rectifying are accomplished at one operation, the empyreumatic oil being retained by the charcoal in the still.

Mr. Henry Wilson, of Stockton-on-Tees, County of Durham, England, has patented an improved apparatus for blowing, cooling, purifying, and otherwise attemperating air. This invention consists in certain novel features in the construction and arrangement of air pumps, suction and blowing engines, and devices combined therewith, for cooling, purifying, heating, and otherwise attemperating air or gas.

Mr. Patrick Shea, of South Boston, Mass., has patented an improved ironing board clamp, for securing an ironing board upon and above the top of an ordinary table, also in providing a support for the flat iron. The invention consists of a frame composed of two horizontal parallel bars, whose inner ends are respectively secured in the upper and lower edges of a block, which, with the bars, is designed to rest upon the table top to support the ironing board, said bars having their outer ends secured in the vertical slot of a head block

that has a flange projecting inward at right angles from each end.

Mouth-pieces or holders for cigars and cigarettes have heretofore been made from glass by a moulding process, which leaves the articles thin at the mouth-place, where they are most liable to be broken. Mr. Adolph Demuth, of Brooklyn, N. Y., has patented a glass mouth-piece for cigars and cigarettes with an extra thickness of material at the mouth part, where most required.

MECHANICAL INVENTIONS.

Mr. Henry A. McLaughlin, of Karna City, Pa., has patented an automatic grain and liquid weighing scale. In this weighing scale a revolving wheel, provided with buckets and held stationary by spring catches for the reception in a bucket of the material to be weighed, is automatically dumped. Combined with the revolving bucket wheel is a pivoted delivery spout arranged beneath a hopper which supplies material to the wheel. This spout has a counter-balance arm or weight which serves to adjust it into a non-delivering position as the bucket wheel attached to the rack of the scale commences to sink by the weight of material in a bucket. A spring also acts upon the spout in a like direction. The ascent of the dumped wheel and its attached rack adjusts said spout into a delivering position. The apparatus is also provided with a cam shaft which, on being turned, causes a scraper or scoop at its middle to carry small finishing quantities of the material to be weighed into the bucket, after which the rack and bucket continue their descent and the spring catches which hold the bucket wheel are released by hammers, and the bucket wheel is left free to rotate for the purpose of dumping its load.

An improved clothes washer has been patented by Mr. William Watlington, Jr., of Stony Point, Ind. The object of this invention is to save time and labor in washing clothes. This machine is simple in construction and effective in its operation.

An improvement in machines for winding silk has been patented by Mr. Henry H. Bartlett, of Watertown, Conn. The object of the invention is to soften raw silk and prevent generation of electricity in boiled silk during the process of winding. The invention consists in providing the winding machine with a steam generator for dampening or moistening the silk by a spray of steam, whereby the gum on the raw silk is kept soft, and in the case of boiled silk it is rendered flexible while being wound, and the generation of electricity is prevented. The steam generator for effecting these results is arranged below the swifts of the machine, and is provided with perforations in its upper side for the distribution of steam to the silk on the swifts.

A new fluid pressure regulating valve has been patented by Mr. William M. Sloane, of Brooklyn, N. Y. This invention relates to that class of valves for regulating the pressure of gas, steam, air, or other fluid, or, rather, for delivering such fluid under a uniform and reduced pressure from a reservoir thereof under high pressure, which usually consist of a valve opening against the high pressure and a diaphragm tending to keep this valve open, while the pressure admitted through the valve on one side of the diaphragm tends to keep the valve closed, which actions and reactions cause the gas to be delivered uniformly under the desired pressure, according to the adjustment of the diaphragm.

An improved machine for cutting ice has been patented by Mr. Chauncy A. Sager, of Valparaiso, Ind. The invention consists in the combination with a traction ice-cutting machine of a peculiar laterally swinging cross-cutting device for cross-cutting the ice at right angles to the line of motion of the machine, and while the machine is in motion making longitudinal cuts. The frame of the machine is mounted on wheels and carries a vertically swinging arm having a longitudinally cutting saw attached, operated by suitable mechanism, also carrying a laterally swinging frame depending from a vertically adjustable frame and supporting a longitudinally moving revolving shaft with a cross-cut saw thereon, springs serving to control the longitudinal movement of said shaft. Devices are also provided for holding the pulley which drives this shaft in position and the cross-cut saw and its shaft in place for cross-cutting the ice while the machine is being propelled forward.

Mr. William P. Brosius, of Richmond, Va., has patented a steam gauge for sewing machines. The object of the invention is to provide a device which shall enable the operator to run subsequent rows of stitching in parallel position to and at regulated distances from the first; and the invention consists in a peculiar construction and arrangement of a gauge composed of a spring arm with a stop or guide lug at its lower end, a horizontally adjustable slide carrying said arm, and a block adapted to be attached to the presser foot, which block is connected to the adjustable slide by a set screw and a rib or groove, which prevent the slide from turning axially about the set screw.

NEW SHOT-CASE AND DISTRIBUTER.

The improved shot-case shown in the engraving is of cast iron, japanned and ornamented, and provided with glass windows which expose the different kinds of shot to view. The case contains as many compartments as there are windows, and each compartment has an aperture at its bottom communicating with a hollow cylinder in the center through which works the vertically adjustable valve tube, as shown. The lid fitted to the top of the vessel may be turned independently of the shell. The lid controls and rotates the adjustable valve tube, therefore, if the index knob of the lid is pushed to the center of any division, the contents of that particular division may be drawn by pressing down the tube. A scale pan swings immediately under the discharge tube and receives the shot. When the desired quantity has been weighed the hand is removed from the knob and the flow of shot is instantly stopped. The vessel rests and rotates on a circular stand which supports the weighing attachment, consisting of a simple balance beam, a scoop, and nested weights,

A revolving disk indicates the grade of shot in any division. In the lid there is an opening through which the case is filled. This opening is provided with a cover that swings around automatically and closes the opening, excluding dust. A spiral spring holds the vertical tube and rests upon and presses the automatic cover, keeping it always closed.

This case, aside from being a great convenience in retailing shot and effecting a considerable saving in shot by avoiding spilling, prevents the shot from becoming mixed. It is well



BOOTON'S SHOT-CASE AND DISTRIBUTER.

known to sportsmen that shot of different sizes discharged together will fly irregularly and render the shot inaccurate and ineffective.

For further information address S. Booton, of 105 Worth street, New York city.

IMPROVED VISE.

The vise shown in the accompanying engraving is especially designed for woodworkers, and is capable of being arranged above the bench, or at its side, or underneath. The vise has an outer cylinder, A, cast with the inner jaw, B,

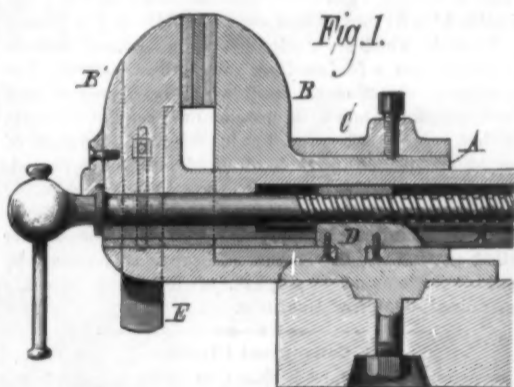
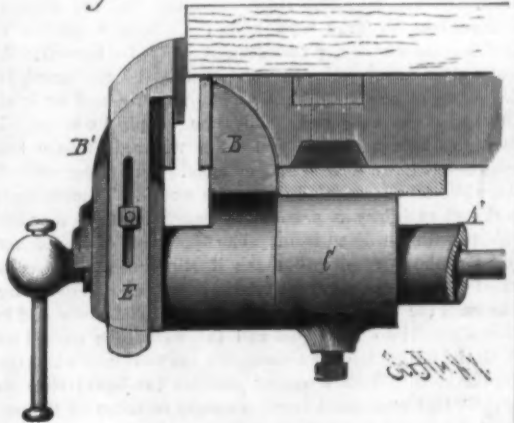


Fig. 2.



HENDRY'S VISE.

and an inner concentric tube, A', is cast with the outer jaw, B'. These jaws may be provided with removable wooden faces to prevent marring planed work when held between them. The outer cylinder is received by a collar, C, cast with a securing base and bolt for the attachment of the vise to the work bench.

The vise is capable of being revolved in the collar, or the collar upon the outer cylinder, to permit of reversing its point of attachment to the under side of the bench, as seen in Fig. 2.

A screw is connected to the inner tube, A', so as to revolve independently and effect its movement back and forth. This screw is received by a tubular nut, D, in the tube, A'.

To the sides of the movable jaw, B', are applied adjustable plates, E, having slots and adjusting screws. These plates have affixed to their front edges a cross piece or face connecting the two plates together upon the inside of the jaw.

By reversing the attachment of the vise to the under side of the bench, as seen in Fig. 2, the face of the device, E, can be presented toward the end of the bench and be adjusted so as to stand above the bench, and hold one end of the board being planed or otherwise operated upon while being held by the usual bench stop at its other end.

This invention was recently patented by Mr. Alexander Hendry, of Fayetteville, Ark.

The Extraction of Sulphur from the Ore.

A new method of extracting sulphur from the rich native ores of Sicily has been invented by MM. de la Tour du Breuil, and the process is perhaps adaptable to other sources of sulphur, notably spent oxide from gas purifiers. The old Sicilian method of roasting the ore and melting the sulphur, in piles similar in construction to charcoal-burners' kilns, was very wasteful, and gave rise to the diffusion of intolerable fumes of sulphurous acid. The new process is very economical, and does not occasion any nuisance. The principle employed is that of raising the boiling point of water, by the presence of a salt, until it just exceeds 115° C.—the melting point of sulphur. Chloride of calcium is the salt employed in this case, on account of its fixity, cheapness, and complete inertia in presence of sulphur at the temperature attained in the process. The mode of operation is exceedingly simple. Two rectangular boilers, coupled together and inclined in position, are heated alternately from one furnace. The liquid, containing 66 per cent of chloride, is introduced into one vessel which is previously charged with sulphur ore. The process of liquefaction takes two hours; and, the other boiler being meanwhile emptied and recharged, the work goes on alternately without interruption. The method is said to be exceedingly economical, the cost of extraction being about five francs per ton. The sulphur is recovered in a state of great purity, and as it is only melted in a water bath instead of sublimed, there are no fumes evolved. The extraction is, moreover, very complete, not more than two or three per cent of sulphur being left in the matrix, even in the case of raw ore; while with such finely divided material as sulphur oxide the residuum irrecoverable by the process would probably be even less. The greatest recommendations of the process are apparently held to be its freedom from sulphurous acid exhalations and its great simplicity, not even a steam boiler being required; although the liquefying vessels might perhaps be heated with advantage by steam pipes, containing steam at a pressure of about twenty pounds above the atmosphere. These and other modifications might be found advisable if the process were tried on a large scale for the continuous treatment of sulphur material.

The Expenditure of Energy in Incandescent Electric Lighting.

At the York meeting of the British Association, Sir W. Thomson and Mr. Bottomley gave the results of some experiments carried out by them in order to determine the illuminating power of incandescent vacuum electric lamps with various strengths of current. Every lamp was tried with higher and higher potentials until the carbon broke. The electricity was obtained from a number of Faure's cells, of which 26 were first put in circuit, developing 0.003 horse power, and others were added until the lamp was destroyed. Three lamps only were tried, the first of which broke down after fourteen experiments; the second lasted through fifteen tests; and the third broke before the third reading could be completed.

With 26 cells the first lamp gave the illuminating power of 11.6 candles; 4 more cells then brought it up to 25 candles; with 32 cells it showed 43 candle power; and successive additions of cells forced the light up through a very irregular scale until, when giving the maximum of 114 candle power, the carbon gave way. The next lamp was first tried with 40 cells, affording 0.27 horse power, and giving the light of 49 candles; and the lamp broke when connected with 70 cells, when the light would have been over 200 candles. The irregularity of all the records is very striking, the power of the batteries and the light given by the lamps being very uncertain and by no means increasing in any common ratio. For example, the first lamp gave the light of 84 candles, with the expenditure of 0.247 horse power, from 40 cells. The next lamp, with the same number of cells, gave only 49 candle power in one instance and 35 candles in another, although the energy of 0.27 horse power was recorded, or nearly the same as before. Again, the second lamp gave 186 candle power with 56 cells, while the addition of 6 more cells, instead of increasing the light, brought it down to 180 candles. Much of this variation is said to be caused by the blackening of the interior surface of the globes by the deposition of volatilized carbon, when high powers were applied. The photometric method employed by the authors consisted of directly comparing the depth of shadows thrown by a pencil on a piece of white paper, and the candle employed was the usual standard sperm article, assumed to burn at the normal rate, but not weighed, as the object of the experiments was simply comparative.—*Journal of Gas Lighting.*

Calcium.

(Symbol, Ca. Combining weight, 40.)

This element, although not existing in nature in the metallic state, is very plentifully distributed in combination with other elements. Chalk, limestone, and many other rock formations contain a large proportion of calcium, and as several of its compounds are applied to many practical and industrial purposes, the study of this element becomes of some importance. The metal itself is prepared with some difficulty by decomposing the chloride by means of a strong galvanic current; when thus separated, calcium occurs as a light yellow metal, which readily oxidizes in the air, forming CaO , the only oxide of the metal known. Calcium also decomposes water with formation of the hydrated oxide and liberation of hydrogen.

Calcium Oxide, or Lime, CaO .—This important substance is obtained by heating chalk or limestone to redness, when the carbonic acid is expelled, and CaO , or *quicklime*, as it is technically called, is left behind. It may be obtained in a state of almost absolute purity by heating Iceland spar or white marble in a crucible to redness; prepared in this way lime is a hard but brittle substance, white in color and absolutely infusible. The lime of commerce, being prepared from an impure carbonate, contains traces of iron, which give a slight yellow color, and also a small quantity of silica, which sometimes causes the mass to partially fuse. When quicklime is sprinkled with water, it slakes with great violence; a chemical combination takes place, with the usual accompaniment of considerable heat, and the hard lime eventually crumbles down to a soft, white bulky powder; this slaked lime is the hydrated oxide, and has the following composition, $\text{CaO}, \text{H}_2\text{O}$. The heat produced during the slaking of quicklime is very considerable, and is a matter of common observation; in some cases it has been found sufficient to char and even kindle dry wood, and fires have been caused in this way. By exposing the hydrate to a strong red heat the water can be driven off, and quicklime again obtained. The hydrated lime is slightly soluble in water, but, strange to say, more so in cold than in warm water; one gallon of cold water (60°Fah.) will dissolve about 90 grains of CaO , while the same quantity of boiling water will dissolve only 60 grains. This lime water possesses a distinct alkaline reaction, in this respect resembling, although to a less degree, the hydrated oxides of potassium and sodium; it is used by the chemist as a test for the presence of carbonic acid, as the surface of the liquid will become instantly covered with a white pellicle of calcium carbonate if exposed to an atmosphere containing any carbonic acid. Quicklime is largely used for building purposes and for increasing the fertility of the soil. Ordinary mortar is made by mixing quicklime, water, and sand together; the mixture, which is at first pasty, gradually hardens, partly by evaporation of moisture and partly by the absorption of carbonic acid from the atmosphere. Hydraulic mortars or cements are made by heating together limestone and a peculiar kind of clay; the burnt mixture contains lime and silica, which to some extent combine on addition of water, causing the mass to set as hard as stone. Lime is also largely used in agriculture as a fertilizer; it is specially valuable on stiff clay lands, where it serves to decompose the silicates of the clay, and thus liberates certain potash salts which are essential to the growth of plants. Lime wash, or milk of lime, as it is sometimes called, is very useful in the brewery for painting the interior of vats and utensils when not in use; the lime acts beneficially by destroying the vitality of any organisms which may have collected on the surface of such vessels, and also by counteracting the acidity which always develops in the pores of unused brewing vessels.

Salts of Calcium.—Several of these are of considerable importance, and are used in many industrial processes; the compounds of calcium have a special interest to brewers, for some are found in most well waters, and are believed to exert a marked influence on the brewing operations.

The carbonate, CaCO_3 , is the basis of most of the other salts of calcium, and is found in large masses in nature, forming whole mountains of limestone and marble, and also occurring in large masses, as chalk, coral, etc. Carbonate of lime, as it is still more commonly called, is practically insoluble in pure water, and yet it is found as a constituent in almost all river and well waters. This is due to the fact that these waters always contain some carbonic acid dissolved in them, and this acid keeps the carbonate in solution. In this way as much as twenty to twenty-five grains of carbonate of lime per gallon are held in solution. The presence of carbonate of lime gives the character of hardness possessed by some waters; but it is only a temporary hardness as distinguished from the permanent hardness produced by other and more soluble lime salts. It is called temporary, because this hardness can be destroyed by boiling the water; the excess of carbonic acid being expelled by heat, the carbonate deposits in the form of a crystalline powder, and often as a hard incrustation, which is a source of great trouble and danger to steam users. In brewing operations this carbonate of lime is rather beneficial than otherwise, for it serves to check any undue acidity in the malt, and for this reason it is not advisable to cause the whole of the carbonate of lime to deposit by violently boiling the brewing water before mashing. An ingenious method of destroying the temporary hardness of the water was suggested by Dr. Clark, whose process consisted in adding a sufficient quantity of lime dissolved in water to combine with the excess of carbonic acid, which then separates in the form of carbonate, carrying down with it nearly all

the carbonate of lime originally present in the water and now no longer soluble, after removal of the carbonic acid. Many suggestions have been made for preventing this incrustation of steam boilers by deposit of carbonate of lime; among the most rational is the addition of some sal ammoniac (chloride of ammonium), which, by double decomposition, leads to the formation of chloride of calcium, a very soluble salt and carbonate of ammonium, which is volatilized by heat; but the objection to this method is the corrosive action which the vapors of carbonate of ammonium exert on engine fittings when the steam is used for obtaining motive power. A better way of preventing incrustation is to add some flocculent matter to the water, which serves as a surface on which the carbonate can deposit, thus preventing the crust being formed on the boiler plates. Chemists use a standard solution of soap for determining the hardness of water, and this solution is made of such a strength that each degree represents one grain of carbonate of lime per gallon. A known quantity of the water being taken, the soap solution is carefully added, until, on shaking the mixture, a permanent lather is formed, which takes place so soon as the lime salts are all precipitated.

The sulphate, CaSO_4 , better known as gypsum, is also found in considerable quantities in some localities, often associated with rock salt; in its natural state the salt is generally combined with two molecules of water, which, however, can easily be expelled by heat, and then the powdered residue is known in commerce as plaster-of-Paris, and is largely used for making casts or moulds, as, on being mixed into paste with water, it becomes hydrated again, and sets into a hard mass. Calcium sulphate, or sulphate of lime, as it is still more commonly called, is slightly soluble in water, one part requiring about 500 parts of water for its solution; like lime, it is less soluble in boiling water than at lower temperatures. Several salts, especially common salt (chloride of sodium), greatly increases the solubility of sulphate of lime in water. Most well waters contain sulphate of lime as a constituent, and brewers have long known that this salt exerts an appreciable influence on the brewing processes; one of the peculiarities of the celebrated Burton waters is the presence of a considerable quantity of sulphate of lime, and it is believed this salt removes from beer worts, or perhaps prevents the solution of certain nitrogenous constituents which are very prone to decomposition, and which, if left in the beer, would lead to its destruction as a drinkable fluid; in whatever way sulphate of lime may act, there is no doubt that its presence in a brewing water materially affects the character and flavor of the beer brewed with it. There is one objection to the presence of sulphate of lime in a brewing water, and that is that it is liable to undergo a reduction to the state of sulphide by removal of oxygen, which change is brought about, there is reason to believe, by minute organisms called bacteria; this sulphide is, in its turn, decomposed as rapidly as it is formed by the acids, which are always present in beer, and sulphureted hydrogen, a foul-smelling gas, is thus evolved. The peculiar and objectionable smell which beers brewed with water containing much sulphate of lime acquire in warm weather, may be accounted for in this way. Sulphate of lime also contributes to the hardness of natural waters, and, not being removed by boiling, it is described as *permanent*; the soap test previously alluded to is also valuable for determining this hardness; by applying it to the well-boiled water—that is, after all the carbonates have been removed by boiling—the amount of sulphate of lime may be easily determined.—*Brewers' Guardian*.

A Convenient Pipette.

Sometimes the chemist hesitates to apply his lips to the end of a pipette when the lower end of it dips into strong ammonia, chlorine water, or, still worse, prussic acid, chloroform, and the poisons. How often the lips are burned with acid or blistered with alkali! C. Mann describes a modification which any chemist can apply for himself. A wide glass tube, that can subsequently be graduated, is drawn out at one end like a pipette and widened or bent outward at the other end. This tube or pipette is passed through a hole in a cork that fits a wider glass tube ten centimeters (four inches) long or more. The upper end of the wider tube is closed airtight with a cork. To make both corks set as tightly as possible in the wider tube they are rubbed with powdered rosin. The upper half of the thinner pipette tube is greased to make it slip through the cork more easily. The narrower tube is shoved up into the wider one until the end is very near the cork. The lower end is then dipped into the liquid and the wide tube pushed up with the finger, leaving a vacuum in the tube into which the liquid rises. With a gentle pressure the liquid rises so quietly that even small drops can easily be taken off the surface of a liquid in a narrow cylinder. Besides using it for corrosive liquid and for taking off the upper or lower of two that do not mix, it can also be employed for taking up slight precipitates on the bottom of a vessel, or for passing one liquid to the bottom of another without disturbing the latter.

Another device for filling pipettes with fuming liquids consists in keeping the liquid in wide mouthed bottles provided with double bored corks, through one of which orifices there passes a short bit of glass tubing bent at right angles. On passing the tube of any pipette through the second orifice and blowing through the shorter tube the liquid will rise to any desired height in the pipette. Most

pipettes have delivery tubes of one size, and hence different pipettes can be inserted successively in the same cork if desired.

Frequently a wash bottle is inserted between the mouth and the pipette, and then the liquid is sucked up into it. Where solutions of chlorine or sulphurous acid are to be pipetted, suction of any sort reduces the pressure and may cause a loss of gas, and leave a weaker solution behind.

P. N.

MISCELLANEOUS INVENTIONS.

Messrs. Nathaniel F. Harris and Martin Thoeni, of Monticello, Iowa, have patented an improved metal can for packing butter, etc., so constructed that air shall be completely excluded from the contents when the cover is soldered on, and so that the molten solder shall not heat the contents, and the cover can be easily unsoldered without injury to the can. The body of the can is formed with an outwardly flaring rim, and the cover also with a flaring rim. These rims are so arranged as to leave a space between them and form a groove for reception of a stripping wire which is soldered to the two rims, and serves to unite the cover with the body of the can.

Mr. James B. Pollock, of Port Richmond, N. Y., has patented a ventilating apparatus for white lead stacks. This invention consists in a combination in a white lead corroding stack or bed with the tiers of pots containing the lead and boards covering the same, of a board lining of the central ventilating flue made in sections, extending from the covering boards of one tier of pots to the bottom of the next tier, and in providing the flue with valves controlling the several tiers, whereby the ventilation may be regulated as required and the tan bark of the stack is prevented from falling into the flue.

Mr. Charles W. Minear, of Kirksville, Mo., has patented a baling press. The object of this invention is to facilitate the compression of hay, cotton, straw, moss, and other substances into bales. In this press the baling box is mounted upon wheels for convenience in moving it from place to place. The power is applied to a horizontal sweep fast upon an upright shaft, and the connection with the follower made by a chain through the intervention of a cam having a sleeve fitting said shaft, a cam plate fast on the latter provided with a spring catch bar, which engages and disengages with the cam, and a lever pivoted to the follower and having a rocking fulcrum connection with the baling box. By revolving the upright shaft the follower is forced forward, and means are provided for automatically releasing, at each revolution of said shaft, the operating cam, which controls the follower chain, also for permitting of the follower being drawn back.

An improvement in tooth brushes has been patented by Mr. Louis Chevallier, of Brooklyn, N. Y. The object of this invention is to provide a brush with a reservoir for water to be used during the application of the brush. The invention consists in the peculiar construction of a brush having attached to its handle an elastic bulb or bag, that communicates with the bristle plate or face of the brush by means of a tubular passage formed through said plate and handle, the end of the tubular handle being extended to nearly the bottom of the bulb, whereby all the water in the bulb may be easily ejected when the brush is held with the bulb downward.

Mr. John Harvey Ludwick, of Dallas, Texas, has patented an improvement in reflectors for lamps and handles thereof. The invention consists in providing the lamp body with a flanged and recessed strip and the reflector with a projecting flange sliding into the recess of the strip, whereby the reflector is securely held in place and is readily detachable when desired. It also consists in a loop and catch connection of the handle of a reflector lamp with the reflector and body of the lamp, to admit of the detachment of the handle. This construction facilitates cleaning, repair, or renewal of the reflector, etc., also transportation.

Mr. Benjamin Goodyear, of Carlisle, Pa., has patented an improved device for handling and carrying jars, bottles, etc., safely and conveniently. The invention consists in a frame formed of a series of wires attached to a handle and to a ring, from which they project downward, and have their lower ends bent toward each other, so as to catch under the bottom of the bottle or jar.

Henry H. Heise and John H. Kauffman, of Columbia, Pa., have patented a steam generator for cooking feed, sweating tobacco, and other purposes. The invention has for its object the combining of simplicity with efficiency and perfect safety. It consists of a cylindrical fire box having a deflecting arch mounted upon a suitable grate and base and provided with a concentric fuel magazine, in combination with a lengthening cylinder for enlarging the fire chamber, and an outer inclosing steam generating chamber provided with the usual boiler appliances.

Mr. Alfred S. Clark, of New Orleans, La., has patented an improved machine for brushing and polishing boots and shoes on the foot of the wearer. The invention consists in a reciprocating rod provided with brushes at the sides and bottom and guided in the legs of a frame, to which a swinging lever is pivoted, actuated by a crank and intermediate cogwheels, and connected with the brush rod, which it reciprocates.

Mr. Christian H. Scheermesser, of McKeesport, Pa., has patented an improved tube drawing mandrel for forming lap welded tubes. It will not stick in the tubes and will permit of quicker and easier drawing and better welding.

WASPS AND THEIR NESTS.

The common wasp is found all over the globe, and is known by its long slender body, colored yellow and black, and by its four wings, two of which are folded double over the back when in repose.

The true wasp is always social, living together in large numbers. Wasps may be divided into three classes, male, female, and neuter; only the two latter are provided with stings. One radical difference between the bees and the wasps is that the wasps do not secrete wax. They build their nests of a gray or reddish paper, formed of fibrous substances that they tear off with their powerful mandibles, and fasten together with their gluey saliva. The arrangement of the cells is also slightly different. Another peculiarity is the desertion of the wasps' nest at the first frost.

The perfect females pass the winter hidden in the moss, on the ground, or in the holes in walls or trees. In the spring they awaken from their long sleep and start out to seek food. They attack the blossoms of the young fruit trees, and, later, the currant bushes. This is the best time to destroy as many wasps as possible, for each female wasp that is killed prevents the formation of a nest.

The food of wasps and the mixture they feed to their larvæ is much more varied than the nourishment of the bees. Wasps are fond of all kinds of sweet things, especially honey, which they often try to steal from beehives. Their tongues are too short to obtain honey directly from flowers, but they attack the ripe fruit where the skin has been broken by rain or birds; they drink the sweet sap exuded by trees, and from these substances they make a tolerably sweet honey, which they store away or feed to their young. Wasps will also seize living insects, even spiders, and tear them apart to feed to the larvæ. In the autumn they will even come inside the window to seize the housefly, and in the woods, one can often notice the sudden disappearance of all flies at the approach of a hornet. They will voraciously devour the meat exposed on the stalls in the market, and often cause serious loss to the careless butcher.

Wasps are much more nocturnal in their habits than bees; and it must be remembered that in the evening, when it is perfectly safe to handle a beehive, it may be dangerous to attack a wasps' nest, as the wasps may still be flying in and out.

In France, the wasps generally make their nests in holes, either in the earth or in trees and walls, and under the roofs of houses. Nests have even been found in old barrels and deserted beehives, the remnants of whose honey had probably served to nourish the intruders.

The underground nests are very brittle and easily broken, as they are made of bits of decayed wood and bark glued together. They are the color of fallen leaves. The common wasp and the "German wasp" are very similar, and generally build their nests in the abandoned holes of the field mice and moles. They dig out the earth to enlarge the nest, and spread it in little piles about to hide the entrance to the hole.

In the ordinary nest the comb is protected by a concentric covering and divided into three distinct parts: 1st. One or perhaps more combs or layers of hexagonal cells. 2d. Pillars that join and support the different combs. 3d. An outside covering composed of several membranes of paper, which is covered with a sort of gluey varnish that is secreted by the wasps' tongues, and gives the nest a silvery varnish. On account of this varnish and the convex form of the nest, neither the rain nor cold can penetrate into it, consequently the temperature of the nest is higher than that of the atmosphere, sometimes being fourteen or fifteen degrees warmer.

The mother wasp commences her nest in the beginning of summer, and first constructs a foundation of woody fibers, which she builds up in the form of a capsule, forming in the center eight or ten cells, to which she adds new cells when necessary.

The first eggs are always working wasps or neuters,

and the mother wasp is forced to leave the nest frequently to obtain nourishment for them. Afterward, when these are grown, they do all the work, enlarging the nest, providing food for the later larvæ; and from this time the working wasps, which can easily be distinguished by their more slender bodies, are the only ones that are found flying.



Fig. 1.—Eggs of the Common Wasp: Larva—1, beneath; 2, above. Nympha—3, above; 4, beneath.

From the first of August to November the mother only lays the eggs of males and perfect females.

The larvæ (Fig. 1), which are white and without legs, are attached to the cell by the extremity of their abdomen, and hang head downward. There are two brilliant spots on their heads, and their mouths are stronger than those of the



Fig. 3.—WOOD WASP AND NEST, SHOWING ARRANGEMENT OF THE LOWER COMBS.

bee larvæ, as they receive tougher food. When the larvæ are fully grown they turn over and weave a slight tissue of silk around themselves and the cell, then, resuming their old position, they close the opening of the cell with a thicker silk, and remain quiet for several days. At the end of that time the larvæ have become nymphæ, which are the complete wasp, covered with a thin skin, through which can be seen the three divisions of the body, with their de-

veloped organs folded under the abdomen. These nymphæ are at first white, and then gradually become colored, commencing always with their black eyes; and for several days after they have broken their coverings the wasps are less yellow than they become afterwards. When fully grown the wasp tears the silk tissue and breaks open its cell with its mandibles and flies out of the nest.

A third species, less known, is the red wasp, which frequents only the woods and builds its nest underground. The nests are small and not populous. These underground nest-builders may be distinguished from the common wasp by their abdomens, which are not all yellow and black, but are either red or striped with red. These wasps have numerous enemies, among whom the volucellis are the most formidable, as they are colored somewhat like the wasp, and consequently can easily penetrate into the nests and eat the larvæ, thus rendering us a great service in those warm dry seasons when the wasps' nests are overflowing with their intolerable brood.

The hornets' nest is much larger than all other varieties, and is usually built in hollow trees or under large roots on the ground, or in old walls, chimneys, etc. These nests, which are composed of a sort of pulp of decomposed wood, are very friable. They have a single envelope, and are always placed in some hole for an additional covering and protection. Hornets are very irritable and will attack in crowds any one who they think will hurt their nest. They seek to attack the places where the body is unprotected by clothes, and as their repeated stings are very dangerous, it is best always to rush to the nearest water and completely submerge one's self.

Strange to say, in spite of the hornet's peculiarities and carnivorous instincts, it has one friend in the insect world. It is a large black coleoptera, the *Velleius dilatatus*, distinguished by the peculiarity that, when disturbed, it drops its body and trains it on the ground like a little lizard. This insect follows the wasp in the evening into the nest, of which it makes itself the protector. It furiously attacks all insects that are hurtful to the young wasps, especially the centipedes, which they continue to shake long after the insect has been torn to death by their powerful mandibles. It is also possible that the

strong odor of muck about the *Velleius* may be pleasant to the hornets and agreeably perfumes their nests. In return, the hornets permit it to eat some of the honey, of which it is very fond.

Though this insect is very timid at first, it soon becomes accustomed to any one who will properly nourish it, and can be easily domesticated in order to observe its habits. It can be taught to take honey from the end of a fine brush, and it will cling so tightly to its food that it is difficult to make it let go.

There are a few wasps that build their nests entirely uncovered, simply attached to the branch of a tree. These nests are made of woody fibers, torn from decayed wood or plants, and are very flexible and elastic.

The concentric envelopes on the outside of the nest have such a great resemblance to gray filtering paper, that it would seem as if the wasps had preceded man in the invention of paper. This species is the wood wasp, Fig. 3. It is a little smaller than the common wasp; the female has a more velvety body, and the neuter is quite smooth. This species is spread all over Europe, except perhaps in Lapland.

There is another group of wasps that are distinguished by the inferiority of their nests, which are never provided with an envelope to protect them from the weather. These nests are simply a comb supported on a strong stand; the cells are oblique or recessed, and more or less numerous according to the size of the brood.

These wasps are more slender than the ordinary wasp, fewer in number, less irritable, and much less destructive to fruits and plants. In the month of April this wasp (Fig. 2) can be seen commencing his little nest in some warm spot exposed to the sun



Fig. 2.—WASPS' NEST WITH THE MOTHER WASP.

but well sheltered from the rain. These wasps are so gentle that even if the nest is carried away the mother wasp will not offer to sting, but clings to the nest or flies close to it. If the branch with the nest on it is carried into a house she will still follow and continue to feed her eggs. When these are hatched they readily become accustomed to the presence of man, and it is possible to observe, at home, the habits and development of these curious insects.

Military Ants of the Amazon.

The *Nineteenth Century* has the following: The most astonishing insects, if not the most astonishing animals, in the world, are the so-called "foraging," or, as they might more appropriately be called, the military ants of the Amazon. They belong to several species of the same genus, and have been carefully watched by Bates, Belt, and other naturalists. The following facts must therefore be regarded as fully established.

Eciton legionis moves in enormous armies, and everything that these insects do is done with the most perfect instinct of military organization. The army marches in the form of a rather broad and regular column, hundreds of yards in length. The object of the march is to capture and plunder other insects, etc., for food, and as the well organized host advances, its devastating legions set all other terrestrial life at defiance. From the main column there are sent out smaller lateral columns, the composing individuals of which play the part of scouts—branching off in various directions, and searching about with the utmost activity for insects, grubs, etc., over every log and under every fallen leaf. If prey is found in sufficiently small quantities for them to manage alone, it is immediately seized and carried to the main column; but if the amount is too large for the scouts themselves to deal with, messengers are sent back to the main column, whence there is immediately dispatched a detachment large enough to cope with the requirements. Insects or other prey which, when killed, are too large for single ants to carry, are torn in pieces, and the pieces conveyed back to the main army by different individuals. Many insects in trying to escape run up bushes and shrubs, where they are pursued from twig to twig by their remorseless enemies, till on arriving at some terminal ramification they must either submit to immediate capture by their pursuers, or drop down amid the murderous hosts below.

As already stated, all the spoils which are taken by the scouts, or by the detachments sent out in answer to their demands for assistance, are immediately taken back to the main army or column by two smaller columns of carriers, which are constantly running in two double rows (one of each being laden and the other not) on either side of the main column. On either side of the main column there are constantly running up and down a few individuals of smaller size, lighter color, and having larger heads than the other ants. These appear to perform the duty of officers, for they never leave their stations, and while actively running up and down the outsides of the column, they seem intent only on maintaining order in the march, stopping every now and then to touch some member of the rank and file with their antennae, as if giving directions.

When the scouts discover a wasp's nest in a tree, a strong force is sent out from the main army, the nest is pulled to pieces, and all the larvae in the nest are carried by the carrier columns to the rear of the army, while the wasps fly around defenseless against the invading multitudes. Or, if the nest of any other species of ant is found, a similarly strong force is sent out, or even the whole army may be deflected toward it, when with the utmost energy the innumerable insects set to work to sink shafts and dig mines till the whole nest is riddled of its contents. In these mining operations the *Ecitons* work with an extraordinary display of organized co-operation; for those low down in the shafts do not lose time by carrying up the earth which they excavate, but pass on the pellets to those above, and the ants on the surface, when they receive the pellets, carry them only just far enough to insure that they shall not roll back again into the shaft, and, after having deposited them at a safe distance, immediately hurry back for more.

The *Ecitons* have no fixed nest themselves, but live, as it were, on a perpetual campaign. At night, however, they call a halt, and pitch a camp. For this purpose they usually select a piece of broken ground, in the interstices of which they temporarily store their plunder.

Transparencies Produced by Luminous Paint.

BY ROBERT VINCENT.

In May last I forwarded a brief account of a plan that I had employed for some time past for producing transparencies. The method is at once so simple and satisfactory, that I do not hesitate again to call attention to it, and to recommend it particularly for making transparencies of large dimensions.

To give some idea of the sensitiveness of the gelatine plates that I employ, I may mention that an ordinary fish-tail burner at six feet distance will produce an excellent transparency in ten seconds, or, if the negative be dense, then fifteen seconds are required. In these circumstances, it may be asked, why resort to any other means of illumination?—there is nothing more handy than a gas jet, or less costly; while if the flame varies a little with the pressure, the difference in practice is scarcely observable.

I will try to explain the advantage of luminous paint over a gas-burner in the production of transparencies. In the

first place, there are few dark rooms in which a suitable jet is to be found, or, if a suitable jet exists, it is not always in a convenient position for making exposures. Again, besides the vitiated atmosphere that results when a number of exposures are made in a close room, with the gas burning some time, there is the inconvenience of turning the light on and off continually during the operation; with a luminous paint screen, on the other hand, no clear intervening space of several feet is required, and its employment does not necessitate increased ventilation.

But the advantage of luminous point for transparencies is best seen when large negatives have to be copied. I have an "Aladdin's lamp," which I purchased of Ihlee and Horne, of Aldermanbury, and for which I paid eight or ten shillings—I forget exactly. This is nothing more than a big surface of luminous paint, framed, and glazed. With it I can produce transparencies up to 15 by 12. To do this with a gas-jet is of course quite possible, if you are at a considerable distance, but it is ten chances to one the whole surface of the negative is not uniformly impressed with the rays, which, under any circumstances, are not parallel. In the case of the luminous paint-screen, however, it is merely necessary to clap the printing-frame (containing the negative and the gelatine plate) face downward upon the "Aladdin's lamp," which has been previously exposed to daylight, and in a few seconds the exposure is complete.

It is a mistake to suppose that the exposure must needs take place the instant the "Aladdin's lamp" is removed from the daylight. If you use the "lamp" fresh, the chances are you will over-expose. Employed within one minute of its withdrawal from light—I am speaking of ordinary diffused daylight—an exposure of one second will often be too much; taking such plates of the sensitiveness I have mentioned, and the normal oxalate development (Dr. Eder's formula), which, for transparencies, at any rate, I much prefer to pyrogallol development. On the other hand, if, instead of using the "Aladdin's lamp" immediately, you wait five, ten, fifteen minutes, after withdrawal from daylight, you will find the light much more under control. I have made a dozen transparencies without re-exposure of the "lamp" to daylight. I find that, with my lamp, an exposure of three or four seconds is required after five minutes' withdrawal, an exposure of fifteen seconds after ten minutes, and an exposure of twenty five seconds after fifteen minutes—this with a negative of normal density. The delicate detail in the shadows so soon gets lost that over-exposure should always be avoided if you want a bright and vigorous transparency.

If your dark-room is not well lit, as soon as you have poured over your developer, you may turn the "Aladdin's lamp" round and use its light to develop by; I have never found any ill effects from its light, if only the development has begun before the "lamp" is made use of.

It is only since I have taken to the production of large transparencies that I purchased an "Aladdin's lamp." For many months I used nothing but a piece of cardboard, coated myself simply with the luminous paint, and protected from dirt by a piece of glass. This answers admirably for whole plates or any smaller pictures, and those who can obtain a small amount of the paint can perfect for themselves an "Aladdin's lamp" up to any size. The paint, when I inquired the price, was 28s. a pound, but a tiny sample I obtained was quite sufficient for the making of my first screen. I do not think there can be half an ounce of paint on the 15 by 12 "Aladdin's lamp" that I have, and therefore, if photographers could only purchase it in small quantities, the cost of a screen would be but nominal. Some of our apparatus dealers would find it worth their while to sell the paint retail, I should think, for any photographer who tries this plan of printing cannot fail to be satisfied with it.

To sum up the advantages of the "Aladdin's lamp" for making transparencies I would say:

The exposure can be more accurately timed than with a gas jet.

The rays being parallel, the transparency is more likely to be uniform in depth and tone.

There is no necessity for a space of several feet to intervene between the source of light and the frame; and finally, the "Aladdin's lamp" is not only more convenient and handy to use, but it does not, like a gas-flame, add further to the vitiation of the dark room.—*Photo. News.*

United States Fisheries of the Great Lakes.

The following statistics of the work of United States fishermen are taken from the report of G. Brown Goode, special agent of the fishery division of the United States Census Bureau, for the year 1879:

In the eight States bordering on the great northern lakes, including Pennsylvania, which has a comparatively limited lake frontage, there were 5,050 fishermen and 1,656 vessels, boats, and steam tugs engaged in taking fish. The value of these vessels, etc., was \$266,000, and the total value of all apparatus and accessories was \$1,345,975.

Of the eight States Michigan stands at the head as regards number of men, and Ohio in the value of investments, the latter being \$233,600; the total fishing properties of the eight being valued at \$497,400 in 1879.

Michigan, notwithstanding the less value of her investments, stands far ahead in the value of fish taken. Of the total, which was \$1,652,900, her share was \$711,605; the next being Ohio, at \$355,000.

Whitefish, the kind taken in the largest quantity from the Michigan lakes, amounted to nearly 13,000,000 pounds, valued at \$461,800, while the value of Ohio whitefish was only \$39,500, or about one-twelfth as much.

The other States stand in the following order in total value of their fish products: Ohio second, \$355,000; Wisconsin third, \$276,005; New York fourth, \$175,100; Illinois fifth, \$53,000; Pennsylvania sixth, \$42,480; Indiana seventh, \$33,820; Minnesota eighth, \$5,200. The whole of the fish taken by fishermen of the last named State are sold in fresh condition, while 11,000,000 pounds of the Michigan and Ohio fish, valued at about \$300,000, are salted for market.

Of the salted fish nearly 600,000 pounds are pike taken by New York fishermen, which were sold for \$12,000, barely two cents per pound.

Michigan, Ohio, Pennsylvania, and New York together sent 2,821,600 pounds of frozen fish to market, which brought \$126,100.

The smoked fish came mostly from Ohio and Illinois, being largely whitefish and sturgeon. The total of smoked fish from the eight States was 1,721,770 pounds, valued at \$109,970.

The report has also a grouping of the investments and products by lakes as well as by States, which shows that about 80 per centum of the investments in fish catching are on Lakes Michigan and Erie, 10 per cent on Huron and St. Clair, 6 per cent on Superior, and 4 per cent on Lake Ontario.

Under this grouping the values present different proportions as follows:

Lake.	Value.	Proportion.
Michigan	\$668,400	about 40 per cent.
Erie	412,280	" 25 "
Huron and St. Clair.....	293,550	" 18 "
Ontario	159,700	" 10 "
Superior	118,370	" 7 "
Total	\$1,652,900	100

There are other tables showing the quantities and values of caviare, isinglass, and oil made from the fish taken on the lakes. They show that all the caviare and most of the oil come from the sturgeon, and that from three-fourths to four-fifths of these three products come from Ohio.

Oil Painting on Woven Fabrics.

Canvas, indeed, is often employed by artists for oil paintings, but then the canvas is stretched tightly on a frame. To paint on loose cloth without entirely destroying its flexibility has hitherto been impossible. Besides this many colors lost their brilliancy, and hence are less effective upon woven fabrics.

Gutmann, of Florence, after many years of experimenting, believes that he has overcome all difficulties, and that with his process the goods will retain their freshness and pliability. The colors shall be as effective as those on the finest printed goods, and even surpass them. If the painting is done on silk or satin the colors have the appearance of enamel, and the shade varies with the gloss of the silk. As neither varnish nor gum is employed the colors preserve their freshness, which is heightened by exposure to the air and light. The colors cannot blacken in time, as is the case with oil colors; and, above all, the goods retain their softness.

A composition made of distilled water, molasses, benzole, turpentine, alcohol, and nitro-benzole, is poured into a vessel containing twice as much boiling water. During the whole operation it is kept at as high a temperature as possible, so that the greatest amount of vapor will be given off. If the mixture gets cold it cannot be used again. As soon as vapors are given off from it the wrong side of the goods is held over it for a few minutes, so that the vapor shall pass through the fabric. After drying for several hours it is ready for use, and may be stretched on a frame or over a piece of wood or cardboard.

In regard to the painting itself, the design is first sketched with an ivory stylus, and using impression paper—red for black or dark stuff and white for light colored. The little oil cans which always belong to the palette, and are generally filled with linseed oil, are now filled with a mixture of benzine, turpentine, alcohol, and nitro-benzole. When the pigment has been put on the palette, one or more drops of this mixture is dropped upon it, in order to dilute the color which is to be used. The pencils and brushes must also be soaked in the same peculiar composition every time before using them. The first coating is put on thick as a ground, so as to cover the stuff well. Everything that is to be pink, blue, or violet must have a white ground, which is allowed to dry one or two days. Little precautions about touching colors not yet dry are to be learned by experience.

P. N.

The Light of the Stars.

For a number of years the special work carried on at the Harvard Observatory, under the direction of Professor Pickering, has been the measurement of the intensity of the light of the heavenly bodies. Some of the results presented at a recent meeting of the Society of Arts, at the Institute of Technology, Boston, indicate measurements almost incredibly fine. The light which falls upon the earth from the satellites of Mars, for example, is about equivalent to what a man's hand on which the sun shone at Washington would reflect to Boston. The labor of measuring the brightness of all the visible stars was begun two years ago. It has since gone on at the rate of about 40,000 a year, and will be completed next fall.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Shafting Straightened in Position by Scofield's Patent Straightener. J. H. Wells, Manufacturer, Vineland, N.J.
New Comb'd Milling and Gear Cutting Machines, large range. C. A. Condé & Co., Makers, Philadelphia, Pa.
Printing presses with Patented Carl Drop. See p. 320.
Latest Improved Diamond Drills. Send for circular to M. C. Bullock, 30 to 32 Market St., Chicago, Ill.

List 27.—Description of 3,000 new and second-hand Machines, now ready for distribution. Send stamp for same. S. C. Forsyth & Co., Manchester, N.H., and N.Y. city.

Abbe Bolt Forging Machines and Palmer Po ver Hammer a specialty. S. C. Forsyth & Co., Manchester, N.H.
New Book.—A Treatise on Iron Founding. By Claude Wylie. Written for practical men. Illustrated. \$1.40. Send for our catalogue of scientific books. E. & F. N. Spon, 446 Broome St., N.Y.

Garfield and Family.—Elegant engraving, 19 x 24, sent for 24 cents (stamp). Sheehy & Co., 33 Barclay St., N.Y.
Don't fail to see the New Automatic Engine built by the Lambertville Iron Works, now in operation at the American Institute, New York.

Mechanics' Watch. \$10. Circular free. Birch, 35 Dey St., N.Y.
Foot Lathes, Fret Saws, &c. 90 pp. E. Brown, Lowell, Mass.

"How to Keep Boilers Clean," and other valuable information for steam users and engineers. Book of sixty-four pages, published by Jas. F. Hotchkiss, 84 John St., New York, mailed free to any address.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Combination Roll and Rubber Co., 37 Barclay St., N.Y. Winger Rolls and Moulded Goods Specialties.

Cope & Maxwell Mfg Co.'s Pump adv., page 254.
Punching Presses & Shears for Metal-workers, Power Drill Presses, \$25 upward. Power & Foot Lathes. Low Prices. Peerless Punch & Shear Co., 115 S. Liberty St., N.Y.

Pure Oak Leather Belting. C. W. Army & Son, Manufacturers, Philadelphia. Correspondence solicited.
Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro. 294 Broadway, New York.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

Peck's Patent Drop Press. See adv., page 309.

National Steel Tube. Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 10 Cortlandt St., N.Y.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsburg, Pa.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr. & Bros., 531 Jefferson St., Philadelphia, Pa.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna nickel, crocus, etc. Hanson & Van Winkle, Newark, N.J., and 32 and 34 Liberty St., New York.

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N.Y.

Saw Mill Machinery. Stearns Mfg. Co. See p. 309.
For Mill Mach'y & Mill Furnishing, see illus. adv. p. 308.

Improved Skinner Portable Engines. Erie, Pa.
For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Out-off Coupling, see Frisbie's ad. p. 286.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 433, Pottsville, Pa. See p. 326.

Safety Boilers. See Harrison Boiler Works adv., p. 285.
Supplee Steam Engine. See adv. p. 270.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv. page 286.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'Frs, 23d St., above Race, Phila., Pa.

Silica Paints (not mixed); all shades. 40 Bleecker St., N.Y.
For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Co., Buffalo, N.Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Ball's Variable Cut-off Engine. See adv., page 300.
Paragon School Desk Extension Slides. See adv. p. 300.

Brass & Copper in sheets, wire & blanks. See ad. p. 300.
The None-such Turbine. See adv., p. 286.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Wren's Patent Grate Bar. See adv. page 301.
Diamond Engineer, J. Dickinson, 64 Nassau St., N.Y.

Berryman Feed Water Heater. See illus. adv., p. 300.
The Improved Hydraulic Jacks, Pumps, and Tube Expanders. B. Dudgeon, 21 Columbia St., New York.

Ajax Metals for Locomotive Boxes, Journal Bearings, etc. Sold in ingots or castings. See adv. p. 300.

Eagle Anvils, 10 cents per pound. Fully warranted.
Geiser's Patent Grain Thrasher, Peerless, Portable, and Traction Engine. Geiser Mfg. Co., Waynesboro, Pa.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N.Y. See illus. adv. p. 301.

For the manufacture of metallic shells, cups, ferrules, blanks, and any and all kinds of small press and stamped work in copper, brass, zinc, iron, or tin, address C. J. Godfrey & Son, Union City, Conn. The manufacture of small ware notions, and novelties in the above line, a specialty. See advertisement on page 301.

Rolled Nickel Anodes, Grain Nickel, Nickel Salts, Platers' Supplies. Greene, Tweed & Co., New York.
Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 301.
The Sweetland Chuck. See illus. adv., p. 300.

Turkey Emery, Star Glass, Pumice, Walrus Leather, Polishes' Supplies. Greene, Tweed & Co., 115 Chambers St., N.Y.

Magic Lanterns and Stereopticons of all kinds and prices. Views illustrating every subject for public exhibitions, Sunday schools, colleges, and home entertainment. 116 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., New York.

Draughtsman's Sensitive Paper. T. H. McCollin, Phila., Pa.
New Economizer Portable Engine. See illus. adv. p. 300.

Cutters for Teeth of Gear Wheels formed entirely by machinery. The Pratt & Whitney Co., Hartford, Conn.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N.Y. Wm. Sellers & Co.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Common Sense Dry Kiln. Adapted to drying of all material where kilns, etc., drying houses are used. See p. 300.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Solomon's Parallel Vise, Taylor, Stiles & Co., Biogelsville, N.J. Skinner's Chuck. Universal and Eccentric. See p. 300.

Don't buy a Steam Pump until you have written Valley Machine Co., Easthampton, Mass.

For Machinists' Tools, see Whitcomb's adv., p. 300.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from \$1 to \$5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) "Harriet and Emily" ask if it is a scientific and philosophical fact and truth that an ice boat can possibly move faster than the wind. A. On good ice a well made ice boat will move much faster than the wind. A wind having a velocity of fifteen miles an hour will drive an ice boat at the rate of forty miles an hour.

(2) E. P. Y. asks: Which do the authorities on such things say is the proper position for sleeping, on the right or the left side, or on the back? A. If soon after eating lie on the right side; otherwise it is best to vary the position occasionally. It is not good to lie habitually in any one position.

(3) "Reader" writes: I have some bottles out of which I wish to make battery jars. Would you please tell me, through SCIENTIFIC AMERICAN, how I can cut the necks off? A. Bend a quarter-inch iron rod so that it will half encircle the bottle. Heat it to a low red heat, place the bottle in the bend upon the line of separation, and turn the bottle back and forth through part of a revolution in contact with the hot rod. When the bottle begins to crack turn it slowly around until the top is completely cracked off.

(4) I. J. M. writes: As you write and deal largely in the saving of "horse power" of one kind, I am emboldened to write asking your assistance in the saving of a horse power of another kind. I have a fine mare, which I am afraid has the itch. Will you be kind enough to let me know what will stop its spreading and cure it? I have tried most of the simpler remedies, such as sulphur and lard, etc., but find them next to useless. A. If the animal is a victim to a genuine case of itch, our opinion is that it will respond to liberal dressings of equal parts of tincture of iodine and glycerine mixed. We would also give two ounces of sublimed sulphur daily in her feed and thoroughly disinfect the harness, blankets, partitions, and in fact everything that has been in contact with her, with a solution of carbolic acid, diluted, the brushes especially, which should not be used upon any other animal.

(5) C. G. B. asks: 1. Can the commercial water glass be mixed with ground marble or other substance to form an artificial marble susceptible of high polish? A. Yes. See article on the subject, page 16, current volume. 2. Could it be colored, and if so, with what, say, for black? A. Lampblack, Indian red, yellow ochre, chrome green, etc., can be used in connection with these materials. 3. Where or of whom can water glass be obtained? A. See column of Business and Personal and Hints to Correspondents. 4. I notice that the "slack" cinders or refuse of soft or bituminous coal that has been burned is composed principally of iron and slate. Could not this be utilized in sidewalks by mixing with some plastic substance that would afterwards harden? What would be the best substance? A. Probably hydraulic cement of bitumen might be employed advantageously in this connection. 5. Please refer to numbers giving instructions for making cement sidewalks. A. See SCIENTIFIC AMERICAN SUPPLEMENT Catalogue. 6. Is there manufactured such an article as asbestos rope, or could rope be cheaply treated so as to resist decay when exposed to weather and moderate fire, and still be strong? A. We believe so. Address the dealers who advertise in this paper.

7. How can cellars without drains be cemented so as

to exclude water and moisture? A. Put down a two-inch bed of concrete with cement, and cement over this for the floor.

(6) W. H. D. asks: 1. Is it best to leave a violin in tune after playing, or is it best to let the strings slack a little after playing? Does it not strain the violin if it is strung up always? A. Leave the violin in tune. 2. Is there anything that will make hair grow longer and stouter when there are plenty of little roots? If there is, what is it and where could I get some of it? A. Pilocarpine (or the hydrochlorate of this alkaloid), when administered by subcutaneous injection, is said to greatly stimulate the growth of hair.

(7) J. H. K. asks: Please let me know what proportion of platinum surface, as compared with zinc surface, to use in a Smee battery, to get the best results? I have seen these batteries in practical use where the platinum surface has varied from two-tenths to forty-one one-hundredths of what the zinc was, and as yet have been unable to find any one who knew what is right. I claim that it makes no difference how much larger your zincs are than the platina (as long as they are as large), and that the power of your battery depends on the size of the plating plates and the condition of the battery bath; but my friend claims different. I also claim that a battery with a platinum plate, 12x12½ inches square, or with 300 square inches surface, with zincs to suit (working in a bath of one ounce acid to 16 ounces water), will deposit a copper shell one-one-hundred-and-fiftieth of an inch thick on a wax electrolyte mould 18x21 inches from a copper anode 15x30 inches square in ten hours, if the connections are good and everything else in order. My friend says I would need large battery plates. A. The quantity of current from such a battery is increased somewhat by increasing the surface of the platinum so as to completely surround the zinc plate. When the cost of the platinum is taken into consideration, however, the gain in current by the increase of platinum surface beyond the dimensions of one of the zinc plates is not sufficient to warrant this modification. It does not matter how large an exposure of platinum surface in excess of that of zinc surface there is in such an element. As we understand your statement of conditions we do not think that your estimate of work done (in copper deposited) is excessive. Of course a stronger current would do the work more rapidly.

(8) J. E. K. asks: Can you tell us of an exterminator for roaches, with which our place is overrun? A. Finely powdered dry borax injected by means of a bellows, into all cracks and crevices infested with the roaches soon drives them away. Another good remedy applied in the same way is genuine Dalmatian insect powder. Chlorinated lime is also very effective.

(9) J. W. F. asks: Please inform me in what work I can find out how to make the material of which paint which is luminous in the dark is made? I do not want it for a paint but for another purpose. There is an article of which oyster shell is one ingredient, but anything that is solid might answer my purpose. A. You will find the information in article on Phosphorescent Substances, page 51, current volume. See also Useful Receipts, in SUPPLEMENT, No. 159.

(10) G. L. says: There is an unlimited amount of chalk, in its rough state, in this vicinity. The chalk is very soft, and is found in lumps of all sizes, and what I desire to know is, how or by what process I could make it suitable for billiard use, such as square blocks of chalk used for chalking cues. A. Reduce the chalk to a smooth thick paste by grinding it with water and about one per cent of wheat flour, mould into shape under pressure, and kiln dry at a temperature of about 100° Fah.

(11) H. L. asks: 1. How is a helix made? A. See "How to Make Induction Coils," in SUPPLEMENT, No. 160, and "Electrical Cabinet," in SUPPLEMENT, No. 161. 2. I have a battery of two carbons and one zinc; how is the connection made between battery and helix? A. Connect the wire from the carbon pole with one end of the helix wire and the zinc pole with the other so as to complete the circuit. 3. How can I make a plain black glass button look like a silver button or to give it a polish like nickel plating? A. See formulae for silvering glass in SUPPLEMENT, No. 105.

(12) H. G. R. says: I have just laid a galvanized pipe, 1¼ inch, from spring to house, a distance of 300 feet. As you do not recommend the use of galvanized iron, can you tell me any way to remove the zinc from the inside of pipe without digging it all up? A. Owing to the unavoidable liberation of gas and the position of the pipe solvents cannot be depended upon to effectually remove all the zinc coating from such a conduit. We know of no practical way of satisfactorily accomplishing this without disturbing the line.

(13) A. B. R. asks: Can you give a recipe for making a cement for fastening rubber bicycle tire to the steel rims? The cement should be applied through the agency of heat, and a stick of it should not be brittle but easily bent at common temperature. A. Try the following: Melt together in an iron pot over a gentle fire, pitch and gutta percha, and stir well together. Use hot. The addition of a little shellac renders the cement harder when cold. See receipts for marine glues under Cements, page 3310, SUPPLEMENT, No. 158.

(14) E. R. G. writes: I have a lever escapement clock, ticking some two ticks per second, and a fast train watch, ticking somewhere about five beats to a second. Hanging my watch at the head of the bed, with the clock on a box by the side of it, my watch seems to lose a beat every few beats. If the clock is removed the watch beats all right, but on being replaced proceeds to drop the beat again. A. The phenomenon referred to is due to the interference of sound waves.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

J. B. S.—Impure potter's clay—useful for making tiles and sewer pipe, etc. (see other report).—G. Van S.—It is not iridium, or osmi-iridium, but magnetic iron sand—

magnetite.—C. B. H.—Kaolin (porcelain clay) of fair quality.—O. E. E.—It is not quartz but glass.—W. C. H.—It is a fair quality of fire clay—useful for making fire bricks and some kinds of cheap pottery tiles and drain pipe. See column of Business and Personal and Hints to Correspondents.—J. K.—The quartz sample contains much cupreous pyrites and doubtless a little gold. An assay would be required to determine this. The crystals are altered pyrites—not tourmaline—and garnets. Stained quartz has no commercial value.—J. F.—Hornblende rock—no value.—F. and B.—Partly altered iron sulphide pyrites. The coating is iron oxide. S. & B.—Argillaceous rock containing crystals of iron pyrites.—T. M.—1. Iron pyrites—iron sulphide. 2. (White). Fine white silica—suitable for glass making, scouring, etc. It is probable that coal exists in the vicinity.—W. E. P.—The quartz probably contains a little gold—an assay would be advisable to determine this.—D. K. E.—An impure potter's clay—similar to that of J. B. S., above.—E. W.—Quartzose rock—probably carries a little silver (see answer to W. E. P.).—A. T. B.—It is an ochre—if properly calcined and ground will make a good cheap red paint.—H. E. B. W.—Siliceous kaolin—of fair quality—could be used by makers of white ware.—E. M. S.—It is limestone and quartzite. The small fragment of metal is lead.—J. M.—No. 1. Contains a large per cent of argentiferous galena. No. 2. Quartz—probably containing a little silver. These are worth assaying.—H. T.—Magnetic iron sand—contains traces of gold. Box marked, "Tucson, Ariz., No. 1" (no letter), contains a sample of quartz rich in horn silver. Box marked "San. Pa." (no letter) contains kaolin of very fair quality. P. W. P.—It is magnetic iron sand—not iridium ore or emery. We have received letters relating to minerals from J. R., E. P. St. J., E. R. B., W. H. S., L. J., H. R. N. J. G., and J. M. W. The samples referred to have either failed to reach us, or, not having been properly labeled, it is impossible for us to identify them.—C. F. H.—The sediment is chiefly composed of iron carbonate and oxide and carbonaceous matter.—J. C. P.—It is iron sulphide—"fool's gold" in a seam of lime carbonate.—J. C. P. (F. A.)—1. Clay slate bearing a concretionary mass of partly altered pyrites and hornblende schist. 2. Compact pyrites rock. Samples in cubed box (no label or letter). 1. Crystallized gypsum—used for making plaster of Paris. 2. Chalcopyrite—iron-copper sulphide in limestone gangue. 3. Iron sulphide in quartz. 4. Lime carbonate.—H. T.—Quartzose rock veined with marmolite.—J. M.—Titaniferous magnetite ore. Package marked "Monroe Democrat," is quartz rock carrying much sulphide of iron—possibly auriferous.—I. K.—Clay iron stone of poor quality.—A. A. R.—1. Quartz and iron sulphide. 2. Fragment of the radiate Favosites goldfuss. 3. A portion of a crinoid or stone lily stem.—S. A. H.—1. A fine argillaceous sand, useful for scouring purposes and in the preparation of some kinds of pottery, enamels, cements, etc. 2. An impure limonite iron ore. 3. Galena—lead sulphide—a rich ore.—J. B. S.—A fair quality of earthy limonite iron ore.—J. R. E.—No sample received.

COMMUNICATIONS RECEIVED.

Theory of Revolving Storms. By J. T. P.
How to Prevent Slipping of Belts. By W. A. R.
On the Fontaine Locomotive. By G. A. T.

(OFFICIAL.)

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were

Granted in the Week Ending

October 11, 1881.

AND EACH HEARING THAT DATE.

[Those marked (r) are renewed patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Abrasive wheel, Fullerton & Coy.	348,098
Agitator or egg beater, D. H. Allen	348,094
Air compressor, Robinson & Kiser	348,119
Amalgamator, A. H. Hamlin	348,171
Animal shears, W. Hassel	348,173
Axle lubricator, L. N. Snedecor	348,225
Barbing machine, A. Van Fleet	348,264
Basin waste, H. M. Weaver	348,076
Bathing tub, H. Costello	348,144
Bearing machine, F. Otto	348,304
Bed attachment for invalids, J. P. Brown	348,105
Bed bottom, A. W. Stewart	348,085
Bed bottom fastening, spring, G. B. Buell	348,130
Bed bottom, spring, E. Bunch	348,037
Bed, wardrobe, A. W. Stewart	348,094
Bell, electric call, H. A. Schoettel	348,115
Bell, gong, G. R. Owens	348,206
Bit. See Bridle bit.	
Blocks, machine for manufacturing cylindrical.	
C. E. Burns	348,018
Blotter, S. A. Piper	348,223
Blue, preparing lenco-base of aniline, O. Fischer	348,159
Boat. See Life boat.	
Bolt. See Rotary bolt.	
Boot and shoe sole buffing machine, J. G. Russell	348,090
Boots and shoes, manufacture of, J. Orcutt	348,109
Bottle, siphon, C. De Quillfeldt	348,147
Box. See Fruit box. Match, etc., box. Show box.	
Brake. See Car brake. Electro-magnetic brake.	
Bread, sandwich, G. L. Wittal	348,267
Brick surfaces, compound for renovating, F. J. Berry	348,011
Bridle bit, J. H. Jones	348,181
Bridges, overhead check rein attachment for, F. C. McKibben	348,105
Bronzing machine, J. H. Bingham	348,012
Broom, Bradshaw & Richardson	348,299
Broom, S. P. Fraley	348,082
Buckle, W. F. Cornelius	348,027
Buckle, G. W. Freeman	348,255

Butter, etc., preservation of, T. F. Wilkins (r)	248,212
Butter, chum, B. Payne	248,210
Butter, cuff, S. Cottle	248,145
Butter fastening, L. A. Bernheimer	248,082
Calipers and rule, combined, P. D. Gramam	248,162
Camera plate holder, A. Herzog	248,175
Can. See Sheet metal can.	
Car brake, P. Lord	248,049
Car coupling, H. L. Gibbs	248,004
Car coupling, J. R. Gilham	248,150
Car coupling, A. Wood	248,245
Car, railway, B. A. Mason	248,148
Car, sleeping, P. M. Melick	248,106
Car step, extension, N. G. Northrup	248,201
Carriage jump seat, J. W. Anderson	248,005
Casting car wheel vres, N. Waaburn	248,241
Chandler, H. E. Shaffer	248,114
Cheek, draft, etc., A. A. Nesbitt	248,106
Chopper. See Cotton chopper.	
Chuck, drill, Croissant & Hurd	248,086
Chuck motor, M. West	248,243
Clamp. See Floor clamp.	
Clay, clay shale, etc., reducing, J. C. Anderson	248,060
Clay grinding machine, Hoxie & Pifer	248,042
Clothes pounder, L. Study	248,252
Cock device, water indicating gauge, J. H. Snyder	248,226
Coloring matter, O. N. Witt	248,246
Coloring master, preparing, O. Fischer	248,154
Colters, machine for beveling plow, R. C. Nugent	248,055
Cooking eggs by hot air, apparatus for, P. L. La- barbe	248,100
Cooler. See Milk cooler.	
Cotton chopper, J. M. Walden	248,237
Coupling. See Car coupling.	
Cultivator, J. C. F. Hammer	248,170
Cultivator tender attachment, L. S. Bates	248,129
Cap. See Oil cap.	
Damper, stove, C. G. Marshall	248,191
Delivery apparatus, J. J. Clause	248,024
Dental flask guide, J. S. Campb.	248,022
Desk school, F. G. Johnson	248,043
Dish, covered, J. A. Eads	248,050
Drum, heating, A. Meyer	248,049
Ear jewels, fastening for, G. W. Washburn	248,240
Electro-magnetic brake, H. Walter	248,238
Elevator. See Hay elevator.	
Elevator safety device, A. C. Ellthorpe	248,120
Engine. See steam engine.	
Exercising machine, S. A. Tuttle	248,121
Extractor. See Stamp extractor.	
Eye-glass, F. R. Woodward	248,079
Fair leader for ropes, etc., J. W. Sharratt	248,061
Fanning mill burdie, J. H. & D. H. Houston	248,178
Feed water heater and purifier, A. Berney	248,008
Feeder, automatic hog, H. T. Phenix	248,211
Fence, H. Orborn	248,032
Fence wire stretcher, S. M. Stevens	248,063
Firearm, breech-loading, W. L. Baker	248,249
Firearm lock, W. Mason	248,130
Firearm, revolving, D. Smith	248,223
Fire extinguisher, Burritt & Castle	248,253
Fire extinguisher, automatic, A. S. Harris	248,058
Fireproof composition, C. C. Gilman	248,092
Floor clamp, J. A. Brown	248,015
Flower crock, A. D. Polgrove	248,218
Frame. See Vehicle dash frame.	
Freezing of water in railway and other tanks, ap- paratus for preventing the, J. R. Kinley	248,090
Fruit box, R. J. Cooke	248,143
Fruit jar, C. House	248,068
Funnel and gauge rod combined, S. T. Bleyer	248,013
Furnace. See Heating and puddling furnace.	
Hot air furnace, Hydrocarbon furnace, Ore roasting and chloridizing furnace, Puddling furnace, Smoke consuming furnace, Straw burning furnace.	
Gas burner, electric lighting, D. Rousseau	248,217
Gas, process of and apparatus for generating water, B. Van Steenberg	248,073
Gate, G. D. Herring	248,040
Globe, mounting terrestrial, H. H. Gross	248,259
Grain binder take-up and tension, M. G. Hubbard	248,261
Grain blower tension, B. F. Farnis	248,001
Grain scourer, A. Selbert	248,060
Grate, J. R. Fish	248,155
Grate, G. Hayner	248,028
Grinding mill, P. Steinmetz	248,118
Harrow, L. Silland	248,221
Harrow, J. H. Stokesbury	248,231
Harvester heading machine, M. B. Erskine	248,254
Hat and bonnet fastening, J. A. M. Bouvier	248,251
Hat finishing machine, Kearsch & Edgett	248,182
Hay elevator, D. Dockstader	248,149
Hay rack, A. G. Barton	248,006
Hay rake and tedder, I. L. Landis	248,185
Heater. See Feed water heater.	
Heating and puddling furnace, W. Rumble	248,029
Heating furnace, B. D. Childrey	248,141
Hinge for brackets, spring, T. B. Cleveland	248,142
Hog scraping machine, M. Crawford	248,067
Holder. See Camera plate holder.	
Hoop planing machine barrel, H. F. Campbell	248,011
Horse detacher, C. W. Bennett	248,250
Hot air furnace, A. H. Brown	248,016
Hub cap, vehicle, O. W. Swift	248,066
Hydrocarbon furnace, Park & Heath	248,110
Ice, machine for the manufacture of, C. V. Gelett	248,157
Insulating substances, filling telegraph cables with, W. R. Patterson	248,209
Jar. See Fruit jar.	
Key for locking bolts, etc., G. B. Taylor	248,067
Keys, manufacture of, H. C. Hart	248,065
Knitting machine, circular, G. W. Lewis	248,102
Ladder, combined step and extension, C. A. Boardman	248,014
Lamp, electric, Fox & Bibba	248,156
Lamp, electric, J. W. Langley	248,157
Lamp, electric, Sample & Babt	248,111
Lamp for sewing machines, C. G. Desprin	248,148
Lamp post, electric, Mason & Westcott	248,189
Lantern, E. P. Follett	248,256
Latch, lifting, F. Clymer	248,005
Lathe, turning, Sellers & Bancroft	248,263
Leather graining and dicing machine, Schray & Brentnigan	248,230
Life boat, A. Holmes	248,007
Life preserving mattress, E. Whitcomb	248,078
Lock. See Firearm lock. Nut lock. Permuta- tion lock.	
Locomotive ash pan, M. B. O'Neill	248,208
Locomotive, compressed air, B. Hardie	248,057
Locomotive spring, T. J. Farrell	248,152
Lubricator. See Axle lubricator.	
Mail bag catcher, J. W. Rochford	248,008
Malt kilns, trap door for, W. Toepfer	248,008
Mash tub, O. F. Boomer	248,094
Match, etc., box, W. Trotter, Jr.	248,234
Match safe, I. L. Landis	248,184
Meteorology, apparatus for, W. Klinkerfues	248,183
Milk cooler, I. C. Whightman	248,120
Mill. See Ore pulverizing mill.	
Mop, G. H. Kidney	248,044

Motion, device for converting, D. Porter	248,214
Motor. See Churn motor.	
Necktie fastening, Standford & Todd	248,228
Nut lock, F. R. Hewitt	248,176
Oil cup, J. Old	248,055
Ore concentrator, W. Thurmond	248,234
Ore pulverizing mill, W. I. Tustin	248,122
Ore roasting and chloridizing furnace, R. A. Nevins	248,199
Ore separator, H. J. Miller	248,196
Organ, reed, H. W. Smith	248,224
Package, hermetically sealed paper, H. C. Crocker	248,146
Packer, oil well, L. Stewart	248,229
Pan. See Locomotive ash pan.	
Paper hanging machine and rack, H. Stalb	248,227
Pen, stylographic, A. T. Cross (r)	9,600
Permutation lock, G. M. Hathaway	248,173
Photographic apparatus, D. H. Houston	248,179
Photography, H. Goodwin	248,093
Pianofortes, repeating action for, D. L. Boller- mann	248,101
Piston and plunger for hydraulic machinery, E. Thayer	248,119
Pitman, A. H. Merriman	248,180
Planter, A. S. Houck	248,180
Planter and fertilizer distributor, combined hand, O. Stoddard	248,230
Plow and drill, combined, Moore & Johnson	248,107
Post. See Lamp post.	
Press. See Roll press.	
Puddling furnace, J. Bergqvist	248,081
Pump attachment, force, French & Anderson	248,032
Pumps, removable cylinder for steam, J. H. Vaile	248,009
Rack. See Hay rack.	
Railway, rope, Chamberlain & Kemp	248,140
Rake. See Hay rake.	
Regulator. See Water regulator.	
Roller press, O. F. Boomer	248,083
Roofing and paving composition, C. M. Warren	248,072
Roofing and paving material, C. M. Warren	248,075
Roofing, paving, and varnish material, C. M. Warren	248,074
Rotary bolt, W. D. Watrous	248,242
Saw, drag, M. L. Nichols	248,050
Saw, hand, L. Lawson	248,045
Saw mill feed mechanism, J. H. Eward	248,151
Scale beam supporting device, W. W. Hopkins	248,177
Scourer. See Grain scourer.	
Screw, H. A. Harvey	248,164
Screw threads, apparatus for feeding blanks to machines for rolling, H. A. Harvey	248,160
Screw threads, feeding mechanism in machines for rolling, H. A. Harvey	248,163
Screw threads, machine for rolling, H. A. Harvey	248,165
Screws and screw bolts, manufacturing, H. A. Harvey	248,168
Screws, manufacture of, H. A. Harvey	248,169
Screws, threading, H. A. Harvey	248,167
Sealing device, J. H. Cassidy	248,086
Sent. See Carriage jump seat.	
Separator. See Ore separator.	
Sewage and venting the pipes therefor, re- moving house, H. Reese	248,216
Sewing machine, button hole, J. H. Munson	248,197
Sewing machine needle, A. F. Gerald	248,158
Sewing machine needles, machine for pointing, R. Thompson	248,120
Shears. See Animal shears.	
Sheet metal can, V. Lopes	248,103
Sheet metal cans, actuating machine for making, J. W. Farrell	248,255
Shirt, T. M. Dunham	248,030
Shoe vamps, machine for folding, K. Vogel	248,071
Show box, J. J. Langlé	248,196
Shutter box, H. B. Ayer	248,139
Signal. See Telephone signal.	
Signaling apparatus, individual, C. E. Buell	248,137
Sinks, sewers, etc., apparatus for the odorless emptying of, U. Götzenbrügger	248,105
Siphon, J. J. Powers	248,215
Slide, double reversible, J. D. McDade	248,104
Smoke and spark consumer, G. H. Burrows	248,019
Smoke consuming furnace, A. Berney	248,007
Soldering machine, J. Graves	248,161
Spark arrester and consumer, A. Berney	248,000
Spark consumer, A. Berney	248,010
Spindle. See Spinning machine spindle.	
Spinning machine spindle, G. W. Stafford	248,092
Spoke feeding machine, rotary, O. Allen	248,124
Spring. See Locomotive spring. Vehicle spring.	
Stage scenery, operating, J. Crossy	248,028
Stamp, electro-magnetic ore, C. F. Pike	248,056
Steam engine, W. M. Henderson	248,096
Steam trap, S. Lawson	248,101
Steam trap, W. O. White	248,077
Steamboat chimneys, operating, J. Christy (r)	9,989
Stone, cutter for machines for cutting cylindrical forms from, J. Gaseley	248,093
Stove reservoir, oil, L. C. Heckman	248,174
Straw burning furnace, W. E. Loomis	248,046
Stump extractor, D. O'Brien	248,054
Supported. See Telegraphic tape supporter.	
Table for sewing and other machines, G. W. Bur- gess	248,065
Tap for beer, etc., J. F. Paulfrans	248,262
Telegraph cables, armoring lead pipes of, W. R. Patterson	248,208
Telegraph line, submarine, J. B. Morgan	248,052
Telegraph relay and sounder, W. E. Davis	248,080
Telegraphic cable, C. E. Buell	248,130
Telegraphic cable, E. A. Schuettel	248,012
Telegraphic tape supporter, E. J. McLoughlin	248,132
Telephone exchange apparatus, C. E. Buell	248,138
Telephone exchange system, C. E. Buell	248,134
Telephone signal, C. F. Buell	248,135
Telephonic and telegraphic system, J. M. Stearns, Jr.	248,115
Telephonic receiver, J. M. Stearns, Jr.	248,117
Telephonic transmitter, J. M. Stearns, Jr.	248,116
Tie. See Umbrella and parasol tie.	
Time piece balance, J. A. Miller	248,050
Tire tightener, B. F. Carlow	248,130
Tongue support, M. Conrad	248,096
Tou, panorama, E. Schiavel	248,219
Toys, mechanical movement for, G. Otto	248,205
Trap. See Steam trap.	
Track bolster, car, E. E. Pratt	248,067
Tub. See Bathing tub. Mash tub.	
Type, H. H. Thorpe	248,238
Type setting machine, W. A. Lorenz	248,047
Umbrella and parasol tie, D. W. Odiorne	248,108
Valve, steam engine, G. A. Gray, Jr.	248,096
Vehicle dash frame, G. M. Peters (r)	9,991
Vehicle spring, S. Childenden	248,092
Vehicle wheel, D. A. Foster	248,207
Ventilator, C. A. Ferdinicks	248,009
Ventilator, J. Patchett	248,207
Vest, L. Wittowsky	248,244
Voting apparatus, A. C. Bernack	248,130
Wagon, dumping, T. D. Hanson	248,222
Wagon, road, E. H. Tow	248,222
Washing machine, P. L. Wickham	248,165
Watch pendant, safety, C. S. Hirt	248,260
Watch regulator, J. A. Awall	248,130

Watch safety pinion, J. A. Awall	248,137
Water closet bowl, porcelain, G. B. Moore	248,195
Water meter casing, Moore & Anschütz	248,194
Water meter, mercury, C. H. Bacon	248,248
Water wheel, turbine, K. Anusson	248,125
Wheel. See Abrasive wheel. Vehicle wheel.	
Water wheel	
Windmill gearing, A. C. Monger	248,061
Wood, composition for filling the pores of, F. Donnet	248,029
Yeast, W. H. Higgins	248,041

DESIGNS.

Carpet, W. L. Jacobs	12,515
Carpet, C. Magee	12,518
Cloths, nap surface for, F. Samson	12,519
Newel post, J. I. Healey	12,514
Statuette, C. Buber	12,522
Tobacco, plug, J. F. Woodridge	12,521
Type, movable, J. A. St. John	12,530
Wall paper, E. Lelander	12,516, 12,517

TRADE MARKS.

Cigars, H. Feltman	8,717
Cigars and cigarettes, J. W. Dinmitt & Co.	8,715, 8,716
Cosmetics, F. Smith	8,715
Cough syrup, W. H. Mix	8,721
Knives, plated silver, J. Russell Cutlery Company	8,723
Knives, table, butcher, and hunting, J. Russell Cut- lery Company	8,724
Matches, Swedish, Jönköpings Tändsticks-Fabriks Aktie-Bolag	8,718
Medical preparation, Weeks & Potter	8,727
Perfume, toilet, G. Kemp	8,728
Pills, anti-bilious purgative, J. F. Smith	8,726
Thread, linen machine, Ross, Turner & Co.	8,722
Tobacco, cigars, and cigarettes, chewing and smok- ing, Leidersdorf & Mendel	8,719
Toilet powders and pomatum, C. Meyer	8,720

English Patents Issued to Americans.

From October 7 to October 11, 1881, inclusive.	
Bessemer converter, A. L. Holley, Brooklyn, N. Y.	
Bolt securing device, G. R. Taylor & Co., U. S.	
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No. 127,929, issued April 15, 1895. A peculiar arrangement of locking bars or hop shifting.

No. 120,328, issued April 24, 1894, relates to improved slide blocks with attachments.

No. 120,345, issued July 21, 1893, and reissued as No. 8,543 and No. 8,544.

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